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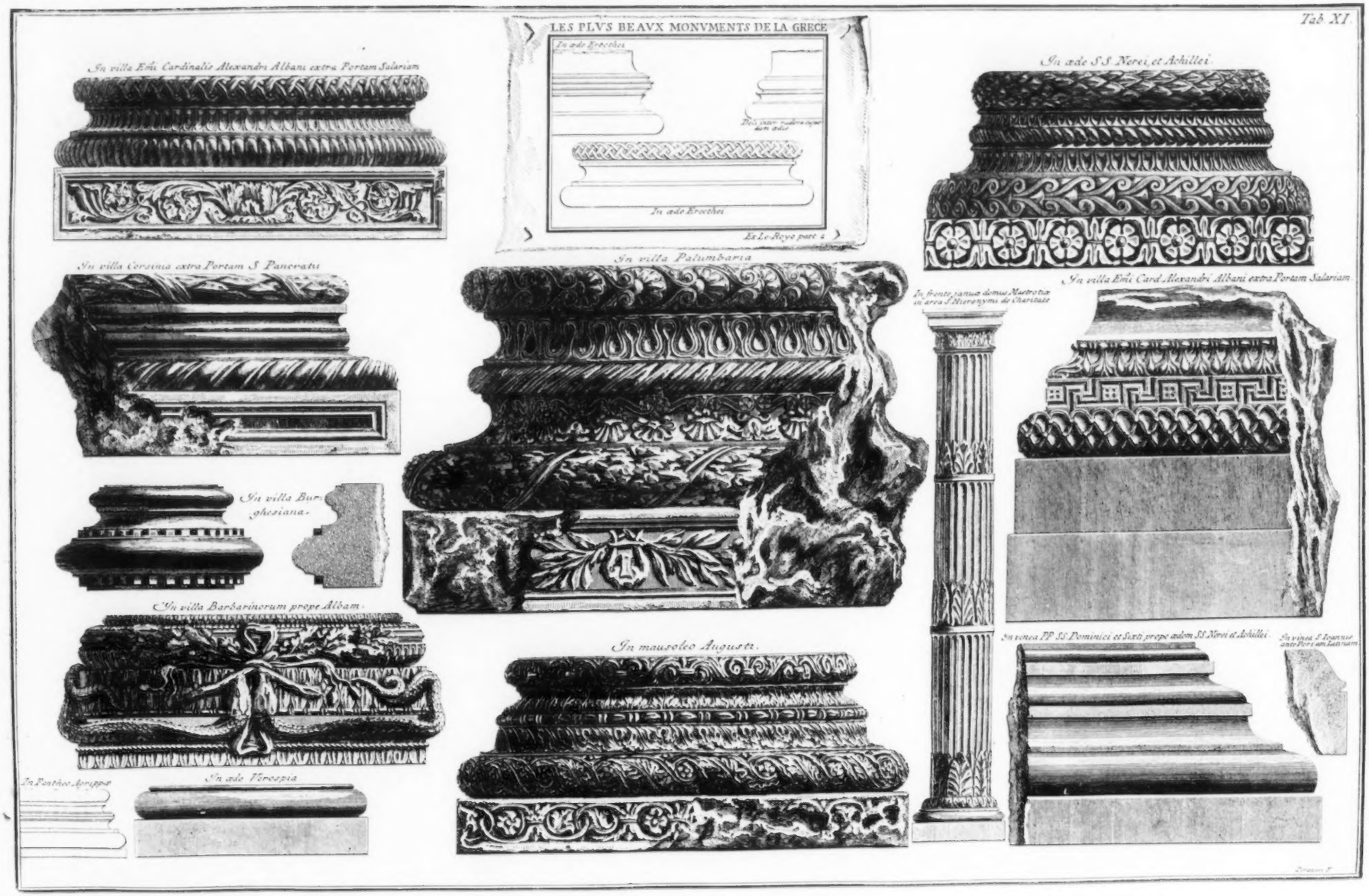
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LES PLVS BEAVX MONVMENTS DE LA GRECE
In ade Erecthei
In ade Erecthei
Ex Le Roye part 2
In villa Emi. Cardinalis Alexandri Albani extra Portam Salariam
In ade SS Nerei et Achillei
In villa Corsinia extra Portam S Panceratii
In villa Palumbaria
In villa Emi. Card. Alexandri Albani extra Portam Salariam
In fronte januæ domus Mactroticæ in area S Hieronymi de Charitate
In villa Burghesiana
In villa Barbarinorum prope Albam
In mausoleo Augusti
In vinea PP SS Dominici et Sixti prope ædem SS Nerei et Achillei
In vinea S Ioannis ante Portam Lat. ium
In Panthæo Agrippæ
In ade Vrcospia

BASES AND A COLUMN FROM ANCIENT ROMAN BUILDINGS, WITH AN OUTLINE DRAWING OF BASES FROM THE ERECHTHEUM, ATHENS.

GIOVANNI BATTISTA PIRANESI, DEL.

THE BRICKBUILDER

VOL. XIX. NO. 8. AUGUST, 1910.

Hints on Architectural Acoustics.

BY HUGH TALLANT.

PART II. (CONTINUED).

COMPUTATION AND PRACTICE.

FOR auditoriums of irregular shape, or which have only one or two dimensions in excess of 50 feet the question becomes one of personal judgment in the particular case. Some special cases will be considered later on in connection with design and construction.

Echo is produced by an isolated sound or group of sounds. In the open, where there is nothing to develop reverberation, echo results from the deflection of some parts of the sound-wave after a single impact against a cliff or hill. In an auditorium it results from the repeated deflection of some sound or group of sounds in a semi-detached portion of the auditorium where the absorbing capacity is below the average. These sounds wander back to the main body of the auditorium after a perceptible interval of time, and as they have been relatively little diminished by impact they may be much louder than what is left of the other deflected sounds. As everyone knows, this phenomenon is apt to occur in connection with a dome, an aisle-chapel or a long corridor. At the same time it by no means follows that such constructions necessarily involve an echo. The distance between deflections is evidently much shorter in a small space than in a large one, and if the relative absorbing capacity is not smaller yet, the reverberation will die out more rapidly in the smaller space. In any special case these facts must be taken into consideration together with the distance of the detached space from the hearer. A low dome may be, and often is, of distinct advantage. Such a case has already been illustrated in Fig. 8 in connection with the question of loudness. The effect of a dome is dependent largely upon the angle at which the direct sound strikes the tangent at the edge farthest from the speaker. In Fig. 10 this edge is shown at A. If the angle SAB is less than a right angle there is no chance of echo, because sounds striking at A will be deflected into the auditorium in the direction AC. There may, however, be sound interference at C, if AC is nearly opposite in direction to SC; and there may be indistinctness at D, if SAD is 80 feet longer than SD. On the other hand if SAB is an obtuse angle as shown in Fig. 11, there will probably be a sharp echo in the vicinity of D or E, and if the sound is deflected as shown in Fig. 12 there will be a prolonged echo throughout the entire auditorium which will be particularly accentuated at D and E. A similar method of investigation may be applied to any other irregularity in the enclosing surfaces of an auditorium, and usually a mere inspection of the architectural drawings will be sufficient to indicate the possibility of echo.

QUALITY OF TONE. The same reasoning which has been applied to loudness and distinctness, applies with even greater force to quality of tone. Methods which give satisfactory results in a small auditorium cannot safely be applied to a large one. In a small auditorium, where the deflected sounds arrive in rapid and unbroken succession the effect of reverberation which they produce tends to support and enrich the natural quality of the sound. It may, however, easily become excessive, and must be carefully computed in advance.

As already mentioned the most convenient measure of reverberation is the time that it remains audible after the original cause has ceased.

The duration of audibility depends upon three factors; the initial intensity of the sound-wave, the average absorbing capacity of the auditorium, and what has been called the "mean free path" between deflections.

The initial intensity is, of course, a variable quantity, but what the architect requires is merely an arbitrary standard as a basis for relative classification. For this purpose it is convenient to assume that the initial intensity is one million times the minimum limit of audibility.

The average absorbing capacity depends upon the relative amount and position of the various absorbing materials composing the walls and contents of the auditorium. If the deflecting surfaces were absolutely non-absorptive a sound-wave would continue to be deflected for some hours from wall to wall before it would be noticeably diminished by the action of the atmosphere. In point of fact, however, few sounds remain audible after more than 200 impacts, and the greater part are destroyed by less than half that number. In the case of any given portion of the sound-wave, it is a matter of chance whether or not it happens to be destroyed early in its course by striking upon highly absorptive surfaces. When, however, the deflections occur with extreme rapidity, each portion of the enclosing walls will receive a number of impacts approximately proportionate to its area, and there is thus established an *average absorbing capacity*, which is readily determined for any given auditorium by dividing the total absorbing capacity by the superficial area of the deflecting surfaces. This calculation does not, however, take account of the shape of the auditorium, which has a pronounced effect. If the shape is such that there is a tendency for the sounds to strike relatively often upon

highly absorptive surfaces, the average absorbing capacity is correspondingly increased. This contingency always arises when the walls and ceiling are intentionally curved so as to deflect the sound immediately to any part of the audience. It also occurs when the rear walls are intentionally inclined so as to deflect the sound to highly absorptive surfaces before it can create interference. These and similar considerations cannot readily be included in a practical mathematical formula, but they must be noted and allowed for in the results of any computation.

The path traveled by any particular portion of the sound-wave is liable to as great variation as is the amount absorbed by deflection. A sound may strike near the corner of the room where the distance between impacts amounts to little or nothing, or it may travel back and forth the full distance between opposite walls. It may even travel in a straight line as far as the longest diagonal of the room, but if the deflections occur with great rapidity there is established a certain average distance, P, between impacts, called the *mean free path between deflections*. In a rectangular room the mean free path is approximately equal to half the average of the three dimensions and the longest diagonal. This value is convenient for architectural purposes, because the three dimensions and diagonal may be readily obtained by direct measurement, but it has the disadvantage of not being applicable to rooms of irregular shape. A value of more general utility is sixty-two one-hundredths of the cube root of the volume.*

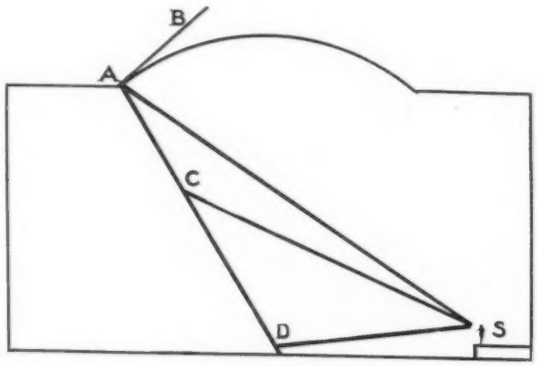


FIG. X

It is to be noted, however, that neither of these values for P takes into account the shape of the room. Nevertheless shape may be a very important factor. Suppose that Fig. 13 represents the section of an auditorium to which the balcony indicated by the dotted lines has been subsequently added. The alteration does not change the general dimensions at all and affects the volume but slightly even if careful deduction is made for the cubic contents of the balcony. The *calculated* value of P will therefore be practically unaffected by the balcony, although the *real* value will be considerably diminished because sounds which originally were able to travel freely from A to B will now be intercepted at C and deflected back to the direction CD. To a greater or less extent any irregularity of form or contents is likely to reduce the value of P, and must be considered in the results of calculations which do not take account of the shape of the room in some other way.

Given the initial intensity, the average absorbing capacity and the mean free path between deflections, the duration of audibility of the deflected sound can be readily calculated.† The most convenient formula for this purpose is —

$$(A + X)\ T = 0.052\ V$$

Here A is the absorbing capacity of the walls, floor and ceiling, X the absorbing capacity of the contents, T the duration of audibility in seconds, and V the volume of the auditorium in cubic feet.

A may be determined by multiplying the area in square feet of each material by the corresponding coefficient from the following table which gives the absorbing capacity of the principal materials of construction at the pitch of middle C.

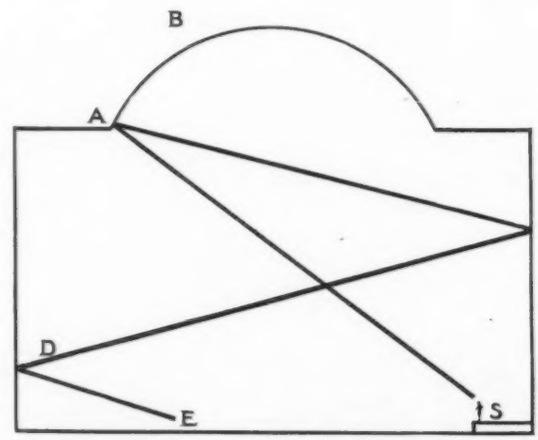


FIG. XI

* The former value was deduced by the writer from theoretic considerations and has proved useful in estimating the rapidity of sound deflection at the beginning of reverberation. The latter is the result of practical experiment by Professor Sabine. If P is the mean free path, X, Y and Z the three dimensions, and V the volume, the two values expressed algebraically are —

$$P = \frac{X + Y + Z + \sqrt{X^2 + Y^2 + Z^2}}{8}$$

$$P = 0.62\ \sqrt[3]{V}$$

In ordinary cases the two expressions give identical results, which is at least a confirmation of their accuracy. For instance, in the case of a room whose dimensions are 2, 3 and 4, the two expressions give —

$$P = \frac{2 + 3 + 4 + \sqrt{4 + 9 + 16}}{8} = \frac{14.4}{8} = 1.8$$

$$P = 0.62\ \sqrt[3]{24} = 0.62 \times 2.9 = 1.798$$

† A formula directly based on these factors can be deduced as follows:

Let I represent the initial intensity, A the average absorbing capacity, P the mean free path in feet, N the number of deflections necessary to reduce the initial intensity to the minimum audibility, and D the duration of audibility in seconds. Then $D = \frac{NP}{1200}$. But $(1-A)^N I = \frac{1}{1{,}000{,}000} I$ whence $N = \frac{-6}{\log.\ (1-A)}$. Therefore $D = -\frac{P}{200 \log.\ (1-A)}$. This formula has only a theoretic interest in this connection as it is less convenient for practical use than the one given in the text.

Open window	1.000
Wood sheathing (hard pine)	.061
Plaster on wood lath	.034
Plaster on wire lath	.033
Glass, single thickness	.027
Plaster on tile	.025
Brick set in Portland cement	.025
Audience	.96*
Carpeting on heavy batting	.40

X may be determined by multiplying the amount of any given material by the corresponding coefficient from the following table:—

Isolated woman	5.81
Isolated man	5.16
Plain ash settees with solid seats and vertical ribs in back	.42
Plain ash settees per single seat	.083
Plain ash chairs "bent wood"	.088
Settees upholstered on seat and back with hair cushions covered with leather	11.836
Upholstered settees per single seat	3.0128
Upholstered chairs similar in style	3.228
Hair cushions per seat	2.2596
Elastic felt cushions (cotton covered with corduroy) per seat	2.152
House plants per cubic foot	.033
Oil paintings, inclusive of frames, per sq. ft.	.28
Carpet rugs, " " "	.20
Oriental rugs, extra heavy, " " "	.29
Cheese cloth, " " "	.019
Cretonne cloth, " " "	.15
Chenille curtains, " " "	.23
Hair felt, 1 inch thick, 3¼ inches from wall, per sq. ft.	.78
Cork, 1 inch thick, loose on floor, per sq. ft.	.16
Linoleum, loose on floor per sq. ft.	.12

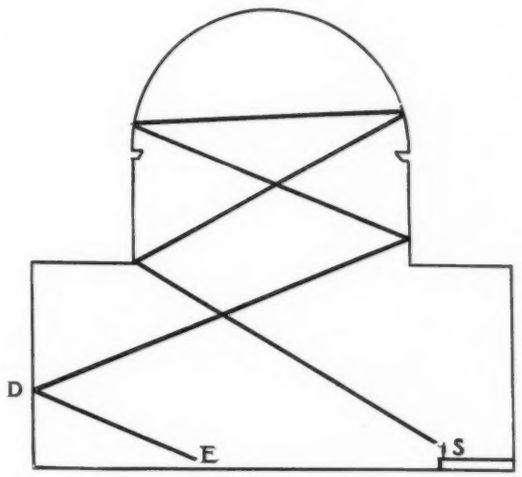


FIG. XII

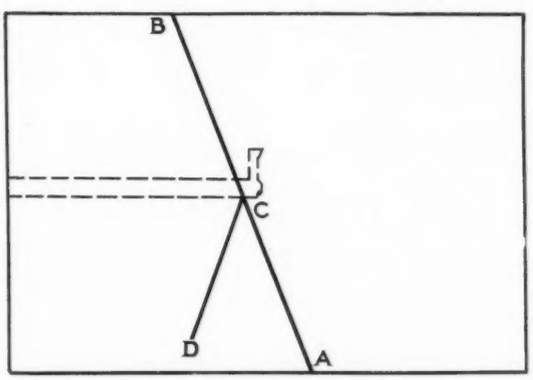


FIG. XIII

In the first table the audience is given as part of the enclosing surfaces of the auditorium. In this case each person is supposed to occupy about 4½ square feet, and the absorbing capacity of the floor and seats is included in the coefficient. Where the audience is distributed over a larger area, each person must be taken separately as part of the contents of the room in accordance with the value given in the second table, and in this case the absorbing capacity of the floor underneath each person must be calculated in addition to the absorbing capacity of the person. The same is true of all the other articles mentioned in the second table whose absorbing capacity must be added to that of the adjacent walls or floor.†

The duration of audibility as computed by the preceding method, establishes a standard by which the relative amounts of reverberation developed in small auditoriums may be compared. Experiments by Professor Sabine have shown that for rooms varying in volume from 2,500 cubic feet to 7,500 cubic feet a calculated reverberation lasting 1.1 seconds gives the most pleasing effect for piano music. Similar calculations by the writer in the case of music-rooms of somewhat greater size have given similar results. On the other hand, for speaking purposes a calculated reverberation of 1.1 seconds is a maximum, and a shorter duration of audibility is preferable. In the absence of data to the contrary these experiments seem fairly to indicate a standard with which other rooms may be compared.

In a practical case the procedure is extremely simple. All that is necessary is to compute the duration of audibility by the method given, and then arrange for the addition of removal of sound-absorbing material until the computation gives satisfactory figures. It is to be noted, however, that this method does not take account of variation in absorbing capacity corresponding to variation in pitch. Two rooms might easily have equal absorbing capacities at the pitch of middle C and very different absorbing capacities at some other pitch. There are evidently theoretic possibilities demanding careful investigation before results can be absolutely guaranteed, but as the character of the materials entering into the construction and furnishings of the ordinary room varies but little, the chances of failure by the method suggested are relatively small.

At the same time it must not be forgotten that the formula upon which this calculation is based does not take into account the shape of the auditorium and the location of the different absorbing surfaces. It is easy, and often expedient, to increase the average absorbing capacity of an auditorium by deflecting a large body of sound

* By a clerical error this coefficient was given as 0.94 in the first article of this series.

† This entire method of computing the duration of audibility is taken bodily from Professor Sabine's treatise by his consent. The same is true of the tables of absorbing capacity with the single exception of the coefficient for carpeting which is the writer's rough estimate.

at once to a surface of high absorbing capacity. Wherever the architect has reason to suspect that this is likely to occur, either intentionally or by chance, he must take careful account of the contingency in his computations. Some suggestions along these lines will be given later on in connection with practical design. Where the average dimension of an auditorium exceeds 50 feet the chance of error in the calculated results becomes so large that it is preferable to attack the problem along totally different lines. The safest procedure is to diminish the reverberation to the utmost possible extent by directing all deflected sound at once to surfaces of high absorbing power. This treatment tends to produce a lifeless quality of tone which while excellent for purposes of distinctness is unsatisfactory in an auditorium devoted to music, and must be offset by the introduction of resonant material as explained in the first article of this series. This method is hardly one of scientific accuracy, but it has never failed to give satisfactory results in the numerous cases which have happened to come under the writer's supervision.

Further investigation will doubtless lead to more definite means of dealing with reverberation in the case of large auditoriums, but in the meantime the procedure suggested is likely to lead to nothing worse than a lack of brilliancy of tone — a much less serious defect than an excess of reverberation and its usual concomitants, indistinctness, and echo.

Planning of Children's Hospitals.

BY CHARLES BUTLER.

THE Children's Hospital as a separate institution is a recent development in the United States. Until a short time ago it was the custom even in large cities to provide for the treatment of children in one of the wards of a general hospital, as is the case in the New York Hospital, the Michael Reese Hospital in Chicago, and others.

The existence of a Children's Ward in a general hospital causes a far greater complication and inconvenience than is offset by the service performed. This result is due to the requirements for observation, isolation, etc. and the tendency which has become apparent of late to care for children in separate institutions is one more step in the economic improvement of hospital practice.

Among the earlier Children's Hospitals should be cited the one at Toronto, known also for its splendid Island Hospital where the patients spend the summer months three miles out in the lake, and for its Nurses' Home which has set a standard for future buildings in that line. More recently Children's Hospitals have been erected in Chicago and Buffalo, while others are being planned for Boston, St. Louis, Philadelphia and other cities.

In Baltimore the Harriet Lane Home for Invalid Children is now in process of erection on the grounds of Johns Hopkins Hospital, and the plans form the basis for this article, the writer having been identified with their preparation through the association of his firm with that of Wyatt & Nolting of Baltimore. In considering these plans it should be borne in mind that the buildings are placed in the grounds and joined to the main buildings of Johns Hopkins Hospital by the corridor which unites all of the buildings to the main Administration Building.

The buildings are exhaustively described, with the idea that from this concrete example it will be easier to draw general conclusions as to the essentials of a Children's Hospital. And it may be added that the work was planned only after a most exhaustive study of the best examples of recently built Children's Hospitals in this country and abroad.

The principle of the composition in plan is as follows: Facing on the long garden or courtyard is the main building of the hospital consisting of a basement and five stories; through the east and west axis of this main building runs the connecting corridor which, in the case of the basement, is continuous while on the first floor the circulation is interrupted by the out-patient department. In the rear of the central portion of the main building is the lecture room and south of this are three one story ward buildings for observation and isolation.

Owing to the connection with Johns Hopkins Hospital there is no need to provide for a laundry. For the present at least it is planned to make use of the main kitchen of this hospital, bringing food in wagons through the basement corridor to the receiving rooms, where access is had to the automatic dumb waiters leading to the diet kitchen on each floor.

Similarly the food wagons can pass along the basement corridor which, lying to the east of the lecture room, leads to the small receiving rooms at the foot of the dumb waiters which serve the three diet kitchens in the Isolation and Observation Wards.

Adjoining the receiving rooms are the soiled linen rooms into which open the clothes chutes from the main building and the three rear wards, so that the transportation of soiled clothes is entirely in the basement. This is an especially convenient arrangement in the case of the rear wards, each of which has also its sterilizing room in the basement in close proximity to the soiled linen room.

By means of this arrangement for basement connection to the three rear buildings it is possible to isolate them completely. Living quarters are provided in the second floor for the nurses on duty in these three wards, so that with the exception of the visits from the medical staff, there need be no communication on the level of the wards.

It is the intention to put all patients in hospital clothing. In as much as in a children's hospital most of the patients are brought to the institution by their parents it

is planned to have the latter carry away with them the clothes worn by the children, bringing them back at the time of the patient's discharge. By this method the space required for locker rooms for patients' clothes is reduced to a minimum, as it is necessary only to provide for the few patients who have no families to care for their effects. For these is provided in the basement at the east end a locker room with adjacent sterilizing room.

To the east of the soiled clothes room is provision for elevator and dumb-waiter machinery and across the hall a room for the fresh air intake and fan.

As none of the help sleep in the building it is necessary only to provide small locker and toilet rooms for their use.

Steam and hot water are furnished from the main power plant of the hospital so that a relatively large part of the basement is left free for laboratories, or for future kitchens if it should be decided to make the hospital independent of the main kitchen.

The main elevator of the building is placed just north of the corridor to the east of the entrance. A short rise elevator goes from the level of the lecture room to the level of the first floor and is planned to permit the transportation of patients in their beds for demonstration in the lecture room.

The general scheme of arrangement becomes more clear as we study the ground floor plan. The east end of the building contains the out-patient department, accessible by an outside incline at the end of the building, which is planned for the convenience of mothers who bring small children in perambulators. Space is also left in the covered corridor to the east of the building for carriages, while the infants are being treated in the dispensary.

The entrance to the dispensary is through a small vestibule, where arrival is under the scrutiny of a nurse in the office overlooking the entry and waiting room. Should a case present suspicious symptoms it is at once directed into the small infectious waiting room which is divided into stalls with high marble partitions. Cases not arousing suspicion pass into the general waiting room. To the west of these waiting rooms are the pharmacy and four examination rooms; the former, which needs but a relatively small area as it is a distributing pharmacy only, opens directly off the general waiting room. In connection with each waiting room there is a toilet. In the main waiting room is also a gas stove so that mothers can heat milk for their infants if they are delayed past feeding time. Each examination room is provided with instrument sterilizer and sink, as are also the infectious waiting room and the nurses' office.

As will be noted on the plans an outside open corridor leads from the infectious waiting room directly to the rear ward buildings, so that patients may be sent directly to the central or observation pavilion or to one of the two isolation wards. This outside corridor also provides direct access to the lecture room so that contagious or doubtful cases may be brought directly before the students, without passing through the main hospital.

To the west of the entrance are the general office and the bath and dressing room for new patients, where the children are bathed and put in hospital clothes before entering the main hospital wards. On the north side are two working laboratories and west of these are two bed rooms and a bath for internes, as well as a laboratory and office for the director. From this end of the building access is also provided to the lecture room. This room is placed several feet below the ground floor level to permit of the necessary ceiling height for a very steep amphitheater without raising the roof above the level of the second floor, as this roof like all the five ward roofs, is utilized for a roof garden.

The students' entrance to the lecture room is through a door on the west side which leads into an ample vestibule and by a double staircase to the coat room, and thence to the upper portion of the lecture room. Passing through the open connecting corridor we reach the three rear wards, the center one of which is a true observation ward, having each bed placed in a small alcove with glazed partitions 7 feet high surrounding it on three sides. The service rooms for this ward, as for the two isolation wards, are a repetition on a slightly smaller scale of the service rooms of the general wards in the main building. The same principles of separation of service, which will be noted hereafter in connection with these wards, are seen here; i.e. all food service is by itself, all nursing is by itself, all disinfecting and emptying of bed pans and urinals are separated from the other services and from the patients' bath and toilet services, and finally the housemaids' sink and closet are independent of the nurses' service rooms. In connection with each of these wards is a private room and bath and as each ward is planned for ten beds the three rear pavilions can accommodate in all thirty-three patients.

Each pavilion contains also a small nurses' dining and sitting room, and on the second floor three bed rooms and a bath permitting, as already explained, the isolation of each unit.

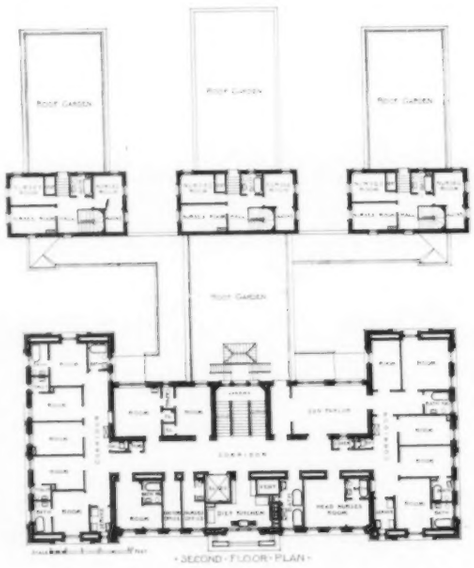
Outside of each pavilion is a coat closet where the attending physicians leave their outer clothes, while just inside the buildings are the lavatories and the lockers containing gowns and caps. The principle of glazed partitions which is referred to in the matter of the observation ward, is also applied to the partition between the sink room, service room and ward on one side, and between the patients' bath room and ward on the other side, in order that a nurse in any one of these rooms may have complete control over the ward proper. The construction of these partitions will be referred to later.

The lecture room contains space for demonstrations, the pit having a diameter of 15 feet with skylight directly overhead. The steps of the amphitheater, six in number, rise rapidly and are shallow in proportion to their height, so that students in the rear rows will still be relatively near the demonstration. An unusual feature is the absence of seats in the amphitheater; a condition which brings the students much closer to the lecturer than could otherwise be possible.

The second floor is divided entirely into private rooms. The central portion contains the diet kitchen placed directly over the entrance and served by a special dumb-waiter from the receiving room in the basement. The diet kitchens contain the usual equipment: steam table with gas heater and plate warmer, refrigerator, sink with porcelain drain boards, cupboards for supplies, porcelain

lined refrigerators, and in place of the usual dressers shelves built of heavy wire mesh so exposed as to leave no gathering places for dust, and tray racks of the same material. These kitchens also contain small utensil sterilizers so that dishes and silver may be sterilized. Live steam also is brought to each drain board, so that milk bottles, cans, etc., may be sterilized without difficulty. The kitchens have floors of vitrified tile, and Keene's cement wainscots 8 feet high finished with enamel as are the wire racks and refrigerators. This description applies to the diet kitchens throughout the building.

To the west of the diet kitchen is a small service room containing the porthole to the clothes chute which can be closed with a heavy cover screwed tight when it is desired to disinfect the clothes chute. Here are also a disinfecting sink and drying closet so that soiled clothes may be disinfected and dried before being sent to the laundry. This room is also repeated on the



SECOND FLOOR PLAN

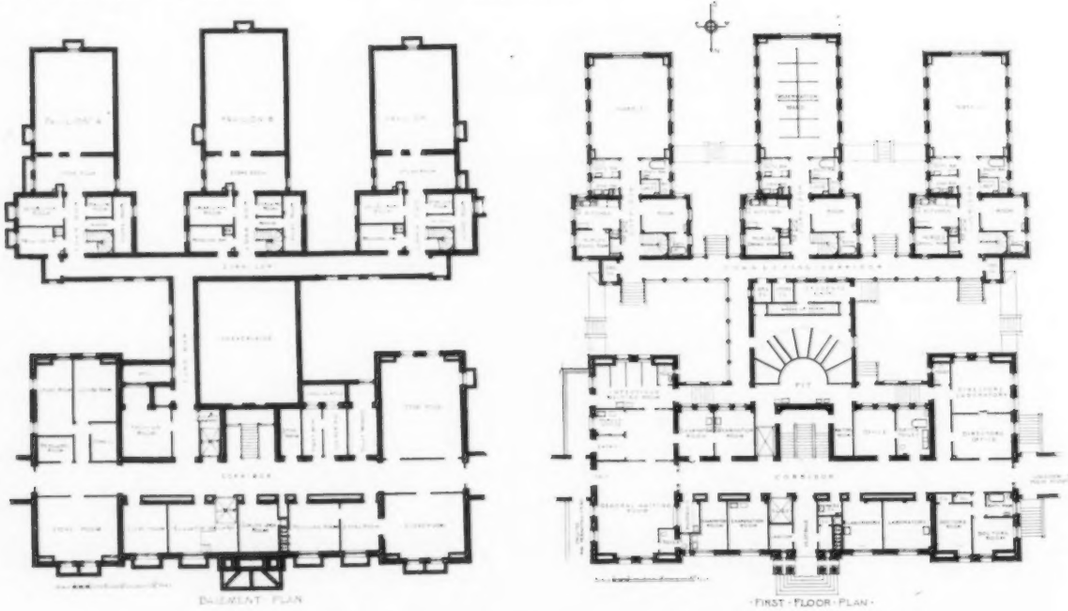
There are on this floor fourteen bed rooms including the head nurse's rooms, some of which are arranged *en suite* as at the southwest corner, others have private baths or private toilets or sharing toilets, while some single rooms have wash basins only; an arrangement adopted to meet the requirements of every purse. To the south of the main corridor is a sun parlor opening on the roof garden over the lecture room.

Like all the roof gardens of the hospital, this one is protected by a rather low brick wall with stone coping so that patients even from their beds are able to see the ground outside. To prevent any possibility of accidents in the case of convalescents, a high wrought iron railing runs from the roof level to a point 5 feet above the coping of the parapet making it quite impossible for the most active children to climb over the top.

The two outside staircases from the upper stories land upon this roof, and in case of fire access may easily be had to the lower roofs of the connecting corridors and thence to the ground at the rear.

Over the three rear wards are also roof gardens cut off from the private floor roof garden by the two story portion of these wards, which is not so high, owing to the lower grades of the rear pavilions, as to interfere with light and air.

The roof gardens over the two outside rear pavilions



BASEMENT PLAN

FIRST FLOOR PLAN

PLANS OF THE HARRIET LANE HOME FOR INVALID CHILDREN, BALTIMORE, MD.
Wyatt & Nolting, Architects, Butler & Rodman, Associated.

upper floors, although in this particular case it is larger in order to provide storage space for the two movable tubs with their supplies and drains.

To the east of the diet kitchen are two small offices for nurses and doctors, essential elements of a private ward plan. There are also separate closets for housemaids, for emptying bed pans, and linen and store closets.

will be especially useful, as on them convalescent contagious cases can enjoy the fresh air without danger to other patients.

The third is a typical ward floor with diet kitchen located and equipped as on the floor below, served by two electric dumb-waiters with automatic control, and with a small service room giving access to clothes chute. It should be mentioned that these clothes chutes are of No. 20 gauge spiral riveted iron, and with the porthole doors above mentioned which may be hermetically sealed for disinfection.

To the west of these rooms on the north front are two quiet rooms and beyond these comes the patients' bath and toilet room with fixed and movable tubs, water closet and lavatory; all separated by marble partitions and wainscots 7 feet high carried down into the tile floors with marble coves.

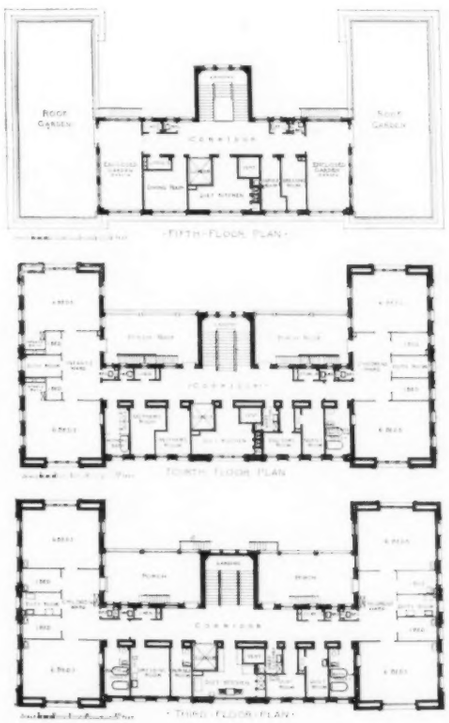
To the east of the diet kitchen is a nurses' office and toilet, and beyond that for the service of the surgical ward at the east end of the building is a surgical dressing room with complete sterilizing outfit for hot and cold water, dressings and instruments, and surgeons' sink. This room has a double sound-proof door and tiled floor and is a most essential part of the equipment of a children's hospital, as in this way the cries of a child having a dressing changed do not demoralize the other patients in the ward.

At each end of the corridor and opening directly into the wards are small closets containing bed pan hoppers. These closets have outside light and ventilation in addition to forced ventilation and contain small vented closets in which specimens may be kept for inspection. Mention should here be made of the fact that the width of the main corridor, 10 feet, is established by the width of the general connecting corridor of the Johns Hopkins Hospital. As this width is not necessary on the floors above the ground floor it has been possible to place the small service rooms, referred to above, in the corridor without unduly constricting it.

Finally the "duty rooms" with gas range for heating poultices, refrigerator for ice for external use, sink, board for charts, and other necessities are placed in the center of each ward, thus completing the separation of the four types of service required in a hospital ward, i.e. patients' toilets and bath, housemaids' service, disposition of feces, etc., and nursing proper.

The wards proper show perhaps the most interesting arrangement in this building; one that is very little known in this country, but found more frequently in Europe. The ward contains fourteen beds separated into four units, two of six beds and two of one bed each. The separation between units is affected by means of partitions 7 feet high of which the lower 3 feet are plastered coming down to the floor with coved base, while the upper 4 feet are glazed. By this means a partial segregation is effected; temperatures at the two ends of the ward may vary considerably while a general circulation of air is maintained.

This scheme of separation gives many of the advantages of the small ward systems so desirable in the treatment of children, while with the glazing of the partitions it becomes possible for one nurse to control the entire ward thus obviating the practical objection to small wards arising from the increased number of nurses required for proper control. The problems of light and ventilation are also simplified by the fact that the partitions are not carried to the ceilings.



PLANS OF THE HARRIET LANE HOME FOR INVALID CHILDREN, BALTIMORE, MD.

The central portion of each ward will furnish a sort of day room where convalescents can be outside of the ward proper while yet being under the surveillance of the ward nurse. Each of these day rooms communicates directly with a covered porch with southern exposure, and planned similar to all the porches and roof gardens so that beds may be wheeled directly out onto them.

The fourth floor is again a typical ward floor with the exception that the east ward is for babies and is therefore slightly different in detail. Instead of taking the babies outside of the ward proper for bathing it has been possible to reduce the one bed units to a small area, and take the requisite space for babies' baths in connection with each six bed unit on either side of the main duty room.

The arrangement of the west ward and of the general services is the same as on the floor below.

The fifth floor is perhaps the most interesting part of this building; starting in the early studies as a typical roof garden, it has been developed until it now contains two roof wards with complete ward services similar to those on the lower floors. To the east of the diet kitchen is a convalescent dining room, one of the most valuable adjuncts of this floor in addition to a wardrobe for heavy wraps.

At each end of the hall is a large enclosed roof ward with windows filling three of the four sides and with direct access to the open roofs. Heat is provided for all of this floor, so that in case of very cold or inclement weather the enclosed wards may be heated like the rest of the hospital, while in good weather patients' beds

may be run directly out onto the open roof where awnings are to be installed for summer use.

The plumbing of the building is on the lines of modern hospital work with great abundance of lavatories both in wards and service rooms. The problem of lighting is simpler than in a general hospital, for the reason that with children exposed ceiling lighting is not objectionable. Wall outlets are provided in ample quantity and are set at a convenient height from the floor so that a nurse can insert a plug without stooping, while the type of receptacle is such that children cannot stick their fingers into it.

The mechanical equipment of the hospital is relatively simple. Fresh air is forced into wards, the general waiting room of the out-patient department and a few other rooms, but in general the windows are counted on for the supply of fresh air to the building. Vents for foul air are provided throughout and a draft is assured by an aspirating coil at the top of the general vent duct, into which all the branch vents are gathered in the space between the fourth floor ceiling and the roof. The air forced into the wards is tempered but is in no way counted on for heating purposes, as all heating is through direct radiation by a hot water system. Steam is furnished for the numerous sterilizers and steam tables, gas is supplied for emergency lighting and gas heaters, and the vacuum cleaning system runs through the building with outlets on each floor. A stand pipe is also carried up through the building with outlets on each floor and roof.

In construction, the building is fireproof, with the walls of brick and the floors of concrete and tile in combination.

The finish of the floors in wards and private rooms is plain brown imported linoleum on cement. This linoleum can be had in 12 foot widths, so that in the 24 foot wards of this building there is but one joint which is to be made tight with cement.

The kitchens, toilet, sink and service rooms are floored with tile while the ground floor corridor, out-patient department, lecture room and central portion of the upstairs corridors have terrazzo which is combined with composition flooring in the corridors and gives way to linoleum flooring in upstairs corridors in order to prevent the noise which is unavoidable with a terrazzo floor.

The base throughout the building is of composition 8 inches high with a 1 inch cove finishing with rounded top ⅛ inch out from the line of the plaster at the top and flush with the finish floor.

The walls of the small sink rooms and of general toilets are of marble to a height of 7 feet, while Keene's cement wainscots are used in kitchens, dressing rooms, etc.

All the interior woodwork is of enamel finish while the walls are painted with oil paint, with the darker tints near the floor and the lighter tones for the upper part of walls and ceilings.

The divisions in the wards are solid 2 inch partitions from the floor level for 3 feet with 4 feet of glass above. The top members of partitions and capping members of solid portions of partitions are rounded in section, of copper built up like show window construction and stiffened with small steel angles and tees. The round sections allow few lodging places for dust and can be easily wiped clean with a damp cloth. It is intended to enamel all this metal work as well as the radiators to match the general tone of the walls.

The stairs are of steel with marble treads and terrazzo landings having gates at each floor. The outside fire escapes take the form of staircases similar in rise and tread to the inside stairs and lead down from the two roof gardens, through the third and fourth floor porches, to the second floor roof garden over the lecture room whence easy access is had to the roof of the porch connecting the main building with the rear pavilions, as already described.

All of the roof gardens have floors of red promenade tile, with sockets built into the roofs to receive the bottom of the awning supports.

The doors to elevators are of the accordion type to avoid the noise and shock which arise from sliding doors, and are covered with copper and glazed with wire glass.

The sills throughout the building, whether of marble or cast iron, are set absolutely flush with the floors in order to offer no obstruction to the wheeling of beds, while in the case of outside sills the top surface slopes about 1 inch to the outside finishing flush with the outside and inside floors.

The type of outside shutter adopted is one which has proved most successful at Johns Hopkins Hospital. While each blind is hinged at the side to swing out, the frame itself is hinged at the top so that it is possible to close both blinds and then push out the entire frame at the bottom, thus protecting the room from sunlight and allowing the air to enter freely. When double and triple windows occur, Jolliffe blinds are employed.

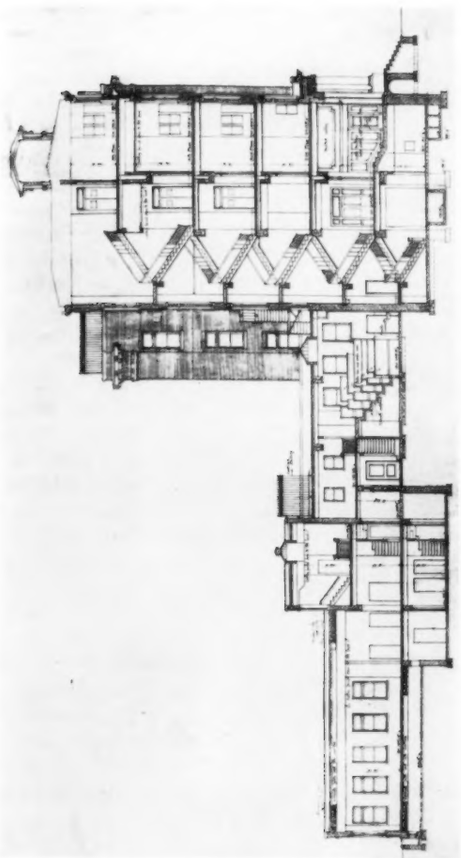
The interior trim is of clear white pine and is reduced to the minimum with rounded surfaces throughout, while the doors are birch veneered hospital doors. Fly screens are provided for all windows and doors.

For the dressers in diet kitchens the example of the Johns Hopkins Hospital has been followed. All the wooden shelving has been replaced by 1⅛ inch wire mesh shelving enameled white and baked. The shelves are set out from the wall and carried by brackets and no closed-in corners are left to gather dust. On the other hand, in a dusty neighborhood it would doubtless be preferable to keep to the old-fashioned type of enclosed dresser. Deeper shelves with cross rods only and no wire mesh are provided for trays.

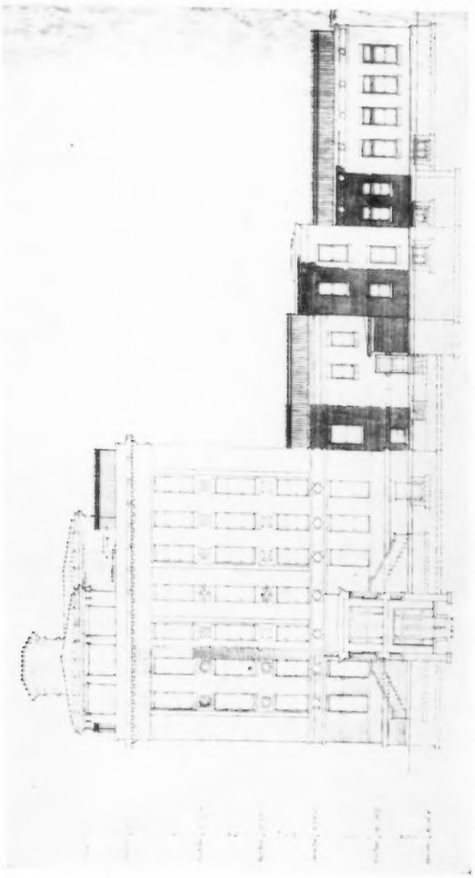
The linen closets have the ordinary wooden shelving set 1 inch away from the walls and with a slot 1½ inches wide down the middle of each shelf for facility in dusting.

The hardware is of plain substantial character. Plain glass knobs are employed, and set higher than is customary so that they will be out of the reach of the smaller children.

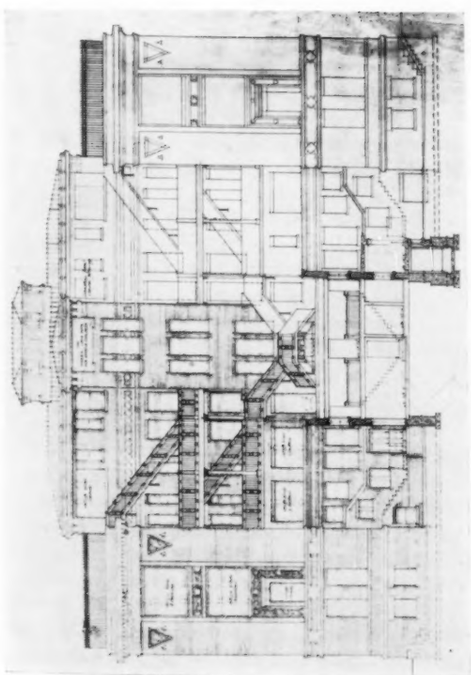
In connection with the main bath rooms it is to be noted that the tubs are raised to a height of 31 inches in place of the usual height of about 20 inches, so as to reduce the exertion required for lifting children into and out of tubs. The general bath rooms each contain a countersunk marble slab, 2 feet by 4 feet with an 18 inch back, supplied with hot and cold water and with a 2 inch waste on which it is possible to bathe the children who are too ill to be put in the tubs. The surgeons' sinks throughout have the "Clover" knee action wastes with foot control supplies.



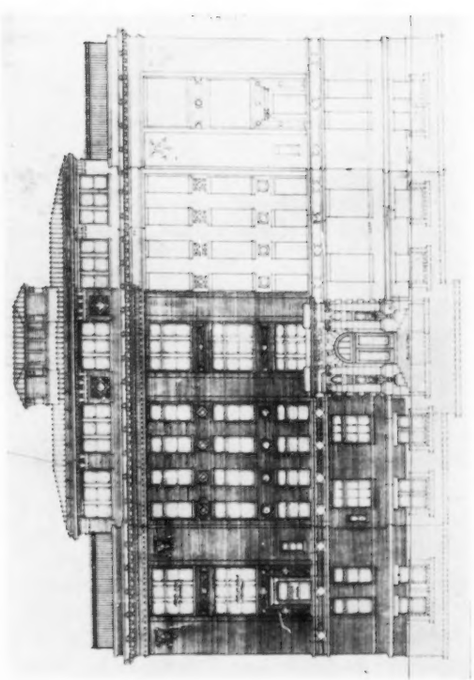
TRANSVERSE SECTION.



SIDE ELEVATION.



REAR ELEVATION.



FRONT ELEVATION.

HARRIET LANE HOME FOR INVALID CHILDREN, BALTIMORE, MD.
Wyatt & Nolting, Architects, Butler & Rodman, Associated.

Disinfecting sinks are furnished for each ward in order that housemaids' sinks may not be used for this work.

The majority of the bed pan sinks are sterilizing sinks and when these are not used clinical sinks with cleaning jets are employed.

In order to avoid the necessity of carrying bed pans through the halls on the private patients' floor each water closet has a movable gooseneck supply so that bed pans may be emptied into the closet, flushed and cleaned on the spot.

The diet kitchen sinks are of porcelain, enameled, the smaller being 20 inches by 30 inches and the larger 20 inches by 36 inches with 24 inch porcelain enameled drain boards at each side through one of which a jet of live steam is brought for sterilizing milk cans, etc.

The type of infants' baths already mentioned consists of two countersunk marble slabs arranged like drain boards, emptying into a porcelain enameled sink. Over these sinks are placed special mixing tanks from which descend a spray on an articulated piping system which may be turned through a considerable radius, supplied with foot control so that the nurse after regulating the temperature of the water has both hands free to bathe the infant. This is an Austrian appliance introduced into this hospital by Dr. Von Pirquet. The infants' bath proper is on the lines of those now in use in the Presbyterian Hospital in New York.

The hospital is well equipped with sterilizers, especially in the general surgical dressing rooms and the examination rooms, dispensary, lecture room, etc. In addition to these utensil sterilizers are set up in each diet kitchen. Blanket warmers are furnished in connection with each ward, those in the infants' ward being placed close to the infants' baths.

In general the Mott type has been adopted with wrought iron piping and screw joints and return elbows, carried under each shelf, but in most cases in order to avoid the annoyance of heating the surrounding air instead of only the blankets, these warmers have been made with double walls and non-conducting linings.

In connection with the disinfecting sinks, drying closets are installed so that objects requiring disinfection may be dried before being sent down the soiled clothes chutes. The plan of these closets includes the heating coils placed at the bottom of the closet with a perforated shelf over and with rods projecting from the back of the closet and supported by brackets on which may be hung the objects to be dried; this type being more easily cleaned than the usual built-in closet.

Porcelain enameled iron medicine cabinets with plate glass shelves and doors are built in the walls of the wards.

The refrigerators in the diet kitchens are of the solid porcelain lined type, each section consisting of a single piece of solid cast porcelain without joints. The outside of the refrigerators is finished in white enamel in place of the usual natural finish, as the white seems more in keeping with the general modern finish of kitchens.

The small ice boxes for ward service rooms are intended only to contain ice for external use and are wood lined only.

The diet kitchens contain combination steam tables and gas ranges with plate warmer hot plate and broiler. The steam table contains one meat and four soup and vegetable jars while each fixture is supplied with a 5 foot hood and vent.

Servants' lockers, also lockers to contain robes and caps for visitors to observation wards are of metal, following out the principle to employ the least possible amount of wood throughout the entire building.

The exterior of these buildings has been treated in red brick to harmonize as much as possible with the present buildings at Johns Hopkins. In order to make the buildings more cheerful inserts of terra cotta and brick patterns have been added. Where no conditions of buildings already existing are met it would perhaps be more appropriate to use light brick with colored tile inserts, as has been done most attractively in both the Children's Hospitals in Buffalo.

First, of all the general essentials of a Children's Hospital, is ample space for observation and isolation. Children should be kept in an observation ward, in certain cases, as long as two weeks before being admitted to the general wards and ample space should be allowed for isolation in case of the outbreak of contagion.

The principle of separation should be carried out throughout the building for children are more easily affected by the condition of those around them, than adults.

The small units of four to eight beds entirely isolated would seem to be even better, but with the absolute separation come the difficulty and increased cost not only of nursing but also of ventilating, so that the compromise system embodied in these plans and already experimented with in Europe seems to offer a practical solution.

The system by which a sort of day room is formed at the entrance of each ward will give an opportunity for keeping convalescents out of the ward proper and yet under the nurse's eye, in bad weather when they cannot be sent to the roofs.

With modern hospital practice, abundance of roof gardens, porches, etc. becomes more and more important, and for children even more than adults this is essential. The roof gardens over the isolation pavilions are also most necessary, as patients recovering from contagious diseases cannot be allowed to play in the gardens with other convalescents and yet must have a place for air and exercise.

The surgical dressing room separated from the ward is an advantage in any hospital, but becomes an absolute necessity in the case of a Children's Hospital.

The arrangement of service rooms in connection with the roofs, so that these may become true roof wards and be used to their full capacity, is a development of the outdoor treatment idea which is applicable to any hospital, but is especially useful in the case of children.

A detail, but one which is too often neglected, is the working out of the fire escapes. In this case they are treated rather as outside staircases with about the same pitch as the inside stairs, and in the upper stories they are placed at the inside of the porches against the wall of the building, so that for those descending them there need be no fear of giddiness nor danger of falling.

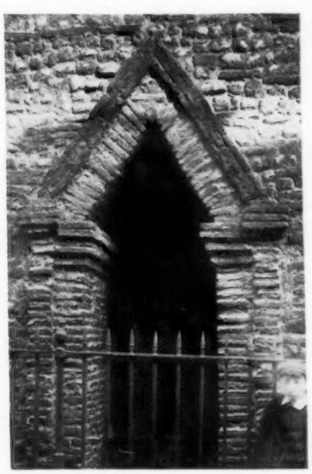
It is plain from this résumé that the problem presented by the Children's Hospital is similar to that of the General Hospital, with an additional need of greater facilities for observation and isolation, and in general, the separation of the patients into smaller units than is customary in the general hospital.

A Chronology of English Brickwork.

SOME months ago, in the journal of the London Architectural Association, there appeared a prize essay by Mr. H. F. Murrell on "The Development of English Brickwork." The matter, as published, would occupy too much space to be included in these pages, but as it is a valuable contribution to the subject, and is likely to be of interest to readers of THE BRICKBUILDER, an abstract is here given. This abstract, it will be seen, is arranged in chronological order, and is supplemented by a series of photographs, illustrating the succeeding phases of English brickwork.

ROMAN BRICKWORK.

B.C. 55-*A.D.* 420. Brick burning and brick building do not appear to have been practised in England prior to the Roman occupation, although existing remains show that the art of pottery was not unknown. In pre-Roman times the forests of Britain formed the happy hunting-grounds of a people whose building needs and ideals were doubtless satisfied by wattle and daub.



WEST DOORWAY, CHURCH OF HOLY TRINITY, COLCHESTER.

On the Roman advent systematized civilization took the place of Celtic disorder. As surely as he fortified his camp and leveled his military road, so surely the Roman introduced the brick-concrete construction which he had already designed for universal service from the Euphrates to the Forth.

That Roman brick-making in England was not confined to the typical flat 2-inch brick tile is evidenced by the remains of roof-tiles preserved in Colchester Museum. These consist of carefully-made channel and bonnet tiles, having finely-cast antifixa with anthemion at the bottom.

The remains of Roman brick-building in England are in no way different from those in other parts of the Empire. There are examples at most of the Southern Chesters of the two methods of employing brick construction; *structura cæmenticia*, a mass of rubble concrete faced in stone, with bonding courses of two or three flat tile bricks, and *opus testaceum*, in which the facing and arch work of the structure is brick. That the Romans had no predilection for brick is evident from the Tyne and Solway wall, essentially a stone structure; yet brick has been found as far north as Perthshire.

The most important British-Roman brickwork is to be found at Dover in the Pharos Tower and at St. Mary-in-the-Castle. In the walls of the former are the usual bonding courses of flat bricks, some of which have ledges for keying purposes. The Jewry wall at Leicester which is about 7 feet thick is built of rough rag-stone and large flat bricks, having fine arches about 14 feet high with double rows of large bricks, which radiate from the center and are bonded by a course laid tangentially to the arch. Richborough, Kent, has walls faced with courses of stone and brick alternately; while some portions of the walls and bastions still remain at Colchester, in Essex.

SAXON BRICKWORK.

A.D. 420-1066. A sudden cessation of scientific construction followed the withdrawal of the Roman troops. Reasonably, it might have been expected that a country familiar for three hundred years with Roman methods and surrounded in all likelihood with magnificent examples of its success would have striven to continue the work, at least for a time. But facts prove otherwise and to the unrest and upheaval, consequent upon the departure of the Romans and the arrival of the Saxons, may be attributed the failure of post-Roman builders to appreciate the basilica, the thermæ, and the villas as other than yards of ready-made building material. With an ignorant and unappreciative vandalism the Saxons misused the Roman material, often building into their arches tapered Roman voussoir bricks upside down; instances of which occur at Brixworth and at Britford, near Salisbury.

Saxon obtuseness is also noticeable at St. Pancras Church, Canterbury, where Roman triangular facing bricks are set with their points outwards. Amongst other instances of Roman bricks built into Saxon churches may be mentioned St. Martin's, Canterbury, which is a very early example, and St. Peter's-on-the-Wall, Essex. The Church of Holy Trinity, Colchester, possesses a fine late Saxon tower showing throughout a consistently intelligent use of Roman bricks adapted to essentially Saxon forms. The west doorway might be claimed as the reasonable initial of English brick development, had its tiles been burnt in Anglo-Saxon kilns.

NORMAN BRICKWORK.

Norman builders, having acquired a developed masonry amongst the fine French building stones, introduced into England a stone tradition for church and castle to be maintained throughout the ages of romantic faith. Yet the Norman, if given Roman bricks as at Colchester, could put them to-

RUINS OF NAVE, ST. BOTOLPH'S PRIORY, COLCHESTER.

gether with far more skill and interest than his Saxon predecessor.

1078. *Colchester Castle.* Largely composed of Roman brick, the fine herringbone band in the courtyard shows how simply this walling, built often with difficulty by the Saxons in stone, could be constructed by the Normans with tiles. The circular newel stair, which is the largest in England, 16 feet in diameter, has its soffit formed of one continuous barrel vault springing from newel to wall, with its brick voussoirs tangential to the sweep of the stair. The Colchester stair vault appears to have been the prolific parent from which were evolved the spiral brick stairs of the fifteenth and sixteenth centuries.

DETAIL OF CHURCH OF ST. MARY-THE-VIRGIN, INGATESTONE.

1116. — *St. Botolph's Priory, Colchester.* These ruins show an ingenious and thorough use by the Normans of Roman brick in columns, arches and arcading. The columns, about 6 feet in diameter, are carefully built in rubble masonry with alternate layers of brickwork, and projecting courses for the abacus and necking of capitals. The arches throughout are of brick, generally in two reveals.

EARLY ENGLISH BRICKWORK.

Evidence will not justify the assertion that no bricks were burnt in England from the time of the Roman evacuation in the year 420 till 1260 the date of the construction of Little Wenham Hall in Suffolk, but it is certain that brick-making as an industry and brick-building as an art did not exist during that period. Shortage in quantity or inferiority of quality in local building stone was met by the early English builders, not by recourse to Roman brick-fields but by importation of Caen stone from France.

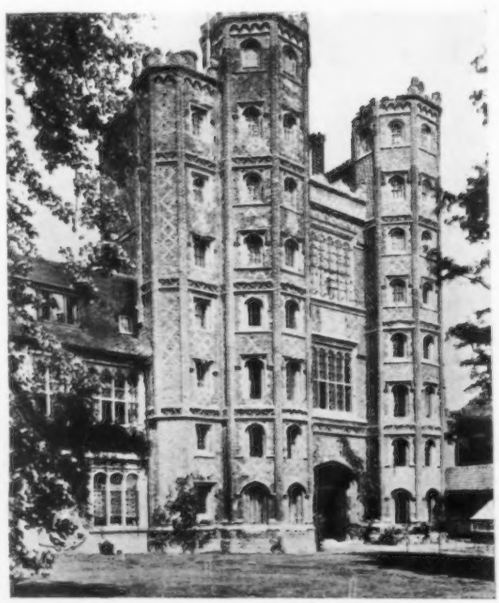
It is evident that the first cause for the re-use of brick was the growing scarcity not only of stone but of timber. The constant destruction of timber buildings by fire must also have hastened the introduction of a more resisting material. This movement manifested itself first in the eastern counties.

1260.—*Little Wenham Hall, Suffolk.* This structure has been long considered the earliest remaining record of the movement already mentioned. Here bricks averaging 9¾ inches by 4¾ inches by 2¼ inches, now dull in color were mixed with courses of stone and flint in the general walling.

1290.— *St. Nicholas Chapel, Coggeshall.* This was the earliest attempt at brick architecture proper. The jambs, mullions and lancet arches of its windows are all of brick, while internally the splayed jambs are finished with moulded bricks at the corners. It would appear likely, however, that the almost isolated examples of Little Wenham Hall and Coggeshall are but the survivors of a considerable group of early brick buildings long since demolished.

DETAIL OF RYE HOUSE, HERTFORDSHIRE.

1400-1500.— *Church Work.* Although throughout the eastern and southern counties churches may be found with brick walls and facings of the fifteenth century yet it was in Essex that brick church architecture mainly developed. But even in Essex the remains are few, including some fine towers, a porch here and an arcade there. The Church of St. Mary-the-Virgin at Ingatestone, in Essex, has perhaps the most imposing fifteenth-century brick tower in the country. The west tower window has brick tracery, and above it are effective crosses in vitrified headers. In addition to the Church of Chignall, St. Nicholas six miles north of Chelmsford, which must also be cited as an excellent example of English brickwork, there are fine brick towers to be noted at Billericay and Castle Hedingham, and brick porches at Burnham-on-Crouch, Castle Hedingham and Pebmarsh.



LAYER MARNEY TOWER, ESSEX.

Brick churches in other parts of the country are less frequent. Granby Church, Nottinghamshire, has an east end in well-moulded brick, while the brickwork of Old Basing Church, Hampshire, is remarkable for its fine color. North Wootten Church near Lynn has also a fifteenth-century brick tower.

Early Tudor Brickwork.

Although the use of brick in church building was fragmentary and incidental, in house work its possibilities were grasped and a style developed which is the most typical of English domestic methods. In cottages and smaller houses brick was early discovered to be a suitable filling for half-timber framing. A fine example is West Stow Hall, Suffolk, where every pattern of brick bonding seems to have been exploited.

Another characteristic of Tudor brickwork is the introduction of diaper patterns, originating in the accidental effects of vitrified headers. In Tudor times the door and window openings were finished in stone except when the more convinced brick builder, by constructing his arches, mullions, and transoms in brick, gave to his work the satisfaction of completeness in one material. Square-headed windows, though not uncommon, seem to have been a difficulty prior to the use of flat-headed arches with radiating voussoirs, a trick to become in Georgian times the *motif* of a style.

Corbelling is a marked feature of Tudor brickwork. It

SOUTH FRONT, EAST BARSHAM MANOR HOUSE.

retained a strong Gothic tradition till well into the sixteenth century, as at Layer Marney, in Essex, and was at its finest in such early work as the Rye House, Hertfordshire.

The chimneys are also a great feature. They were a comparatively new thought to the early Tudor architect. To quite a late date smoke had blackened the rafters of the great Gothic halls ; but when their convenience came to be generally appreciated and the Tudor builders had given careful thought to their treatment, then the most beautiful chimney stacks were produced. Innumerable patterns of cut and moulded brickwork were adopted; such in particular as those at Hampton Court Palace. With the death of Henry VIII., the elaboration of chimneys ceased, those of Elizabeth's time having straight stalks, and an oversailing cap of thin bricks.

The brick newel stairs of the period form an interesting study. They are associated mainly with the early defensive houses before the prominence given to the upper floors in Elizabethan times demanded a more spacious stairway. In their vaulting the constructive ingenuity and originality of their builders, in solving a difficult problem, is exhibited. In the typical stair of Waynflete's Tower at Esher Place, Surrey, which was built about 1500 the newel, vault, handrail and treads are brick throughout.

CHIMNEY STACK, EAST BARSHAM, NORFOLK.

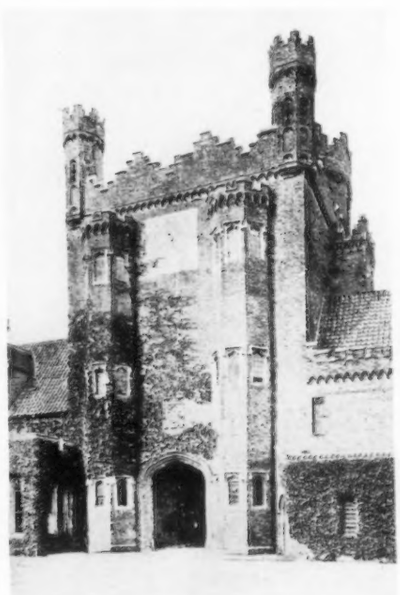
1425. — *Tattershall Castle, Lincolnshire.* According to George Edmund Street, this is "the earliest example of the free use of moulded bricks in a noble architectural work." It contains unusually fine brick vaulting in its passages and stairs.

1440. — *Hurstmonceux Castle, Sussex.* This is essentially a defensive house entirely faced in brick, with the great corbels of its fine machicolated parapet spanned by brick arches. Internally it has several brick spiral stairs.

1440. — *Eton College.* In part this building was commenced in the reign of Henry VI. It is diapered externally and has very fine chimneys.

1440. — *Rye House, Hertfordshire.* Henry VI. granted a license to erect this castellated house (famous for the scene of the well-known conspiracy). Of the original brick building the gatehouse alone remains. The oriels, corbelling, newel stair, and chimney are its chief features.

1440.—*Nether Hall, Essex.* This Hall is of the same period as the Rye House, with which it is reputed to be connected by a secret passage. Unfortunately again the gatehouse alone remains, but from this it is evident that in quality its work was never excelled by the best brick builders of



OXBURGH HALL, NORFOLK.

GREAT SNORING RECTORY, NORFOLK.

East Anglia. Its bricks are burnt hard and in parts almost to a glaze. The construction of the great moulded brick arches spanning from turret to turret is in strong contrast to the fine corbelling with trefoil heads.

1480. — *The Bishop's Palace, Hatfield.* The wall surface of this structure is treated in especially fine diaper work.

1482.—*Oxburgh Hall, Norfolk.* This Hall, while as defensive in arrangement as Hurstmonceux, is treated entirely and architecturally in brick, alike in the great arch across the moat bridge and in the vaulted and ribbed entrance passage beyond.

1490. — *Gainsborough Old Hall, Lincolnshire.* Here is a very fine example of brickwork, partly erected in the reign of Henry VII.

1500. — *Queen's College, Cambridge.* This is another fine example of about the same period as the Gainsborough Hall. The gateway with its towers is particularly noteworthy.

LATE TUDOR BRICKWORK.

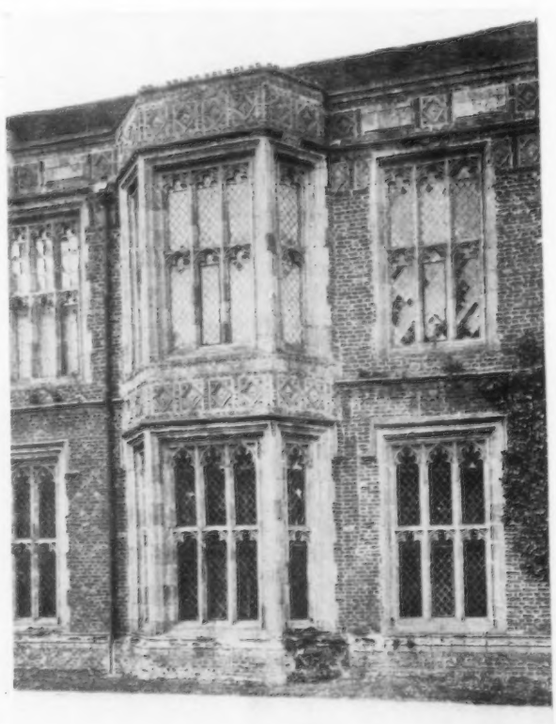
Almost with the turn of the century a new movement was manifested. With the reigns of Henry VII. and Henry VIII., characterized by great domestic building activity, the new Renaissance note with a foreign tone was struck in all the more famous mansions. With brick architecture approaching its climax foreign influence became more felt, and a new material was demanded which would be more in harmony with the general brick walling than stone. Hence resulted a new development in English clay art — the introduction of terra cotta.

1500-1525. — *Layer Marney Tower, Essex.* The most famous brick mansion in England. It well illustrates the tendencies just mentioned. As at Oxburgh Hall, it has a great entrance arch, Tudor windows, brick corbelling and diaper, but its parapet and center windows are of terra cotta, and Renaissance in detail.

1500-1515. — *Wolterton Manor-house, East Barsham, Norfolk.* If not the most famous this is the most perfect brick house in England, and was commenced in the reign of Henry VII. A panel or a head every here and there suggest the new detail, but the general ornament is pure Tudor Gothic. Chimneys and turrets, parapets and strings, blaze with brick heraldry.

1520. — *Great Snoring Rectory, Norfolk.* This Rectory was originally a manor-house, located about a mile from East Barsham. Its terra cotta, in which the interest chiefly lies, is very similar in color and material but the detail shows considerably more Italian feeling.

1515-1520. — *Hampton Court Palace, Middlesex.* This magnificent palace was erected by Cardinal Wolsey and presented by him to Henry VIII. A considerable proportion of the original Tudor Building was demolished by William III. to make way for the new State apartments by Sir Christopher Wren, but there is still a great deal of old brickwork remaining particularly in the Clock Court.



SUTTON PLACE, GUILDFORD, SURREY.

1523-1525.—*Sutton Place, Guildford, Surrey.* The building was one of the great houses of the period of Henry VIII. It shows an unusual mixture of the Perpendicular and the Italian manner in its ornament. In no way defensive and the newel stair discarded, the entire building is an elaborate study in moulded clay.

Nonesuch Palace, Surrey. Although nothing now remains of this palace, it appears from records to have expressed in brick and terra cotta all the energetic exuberance of Henry VIII.

Little Leigh's Priory, near Chelmsford, Essex. This Priory was built by the Solicitor-General to Henry VIII. It is notable not only for the excellent brickwork of the L-planned portion remaining, but more especially for its magnificent detached gatehouse.

The gatehouse situated at Hadleigh, Suffolk, is very similar.

Renaissance Brickwork.

Geographically, the use of brick during the Renaissance period was more widespread than during the Tudor, the center of interest passing from the Eastern to the Southern and South-Midland counties.

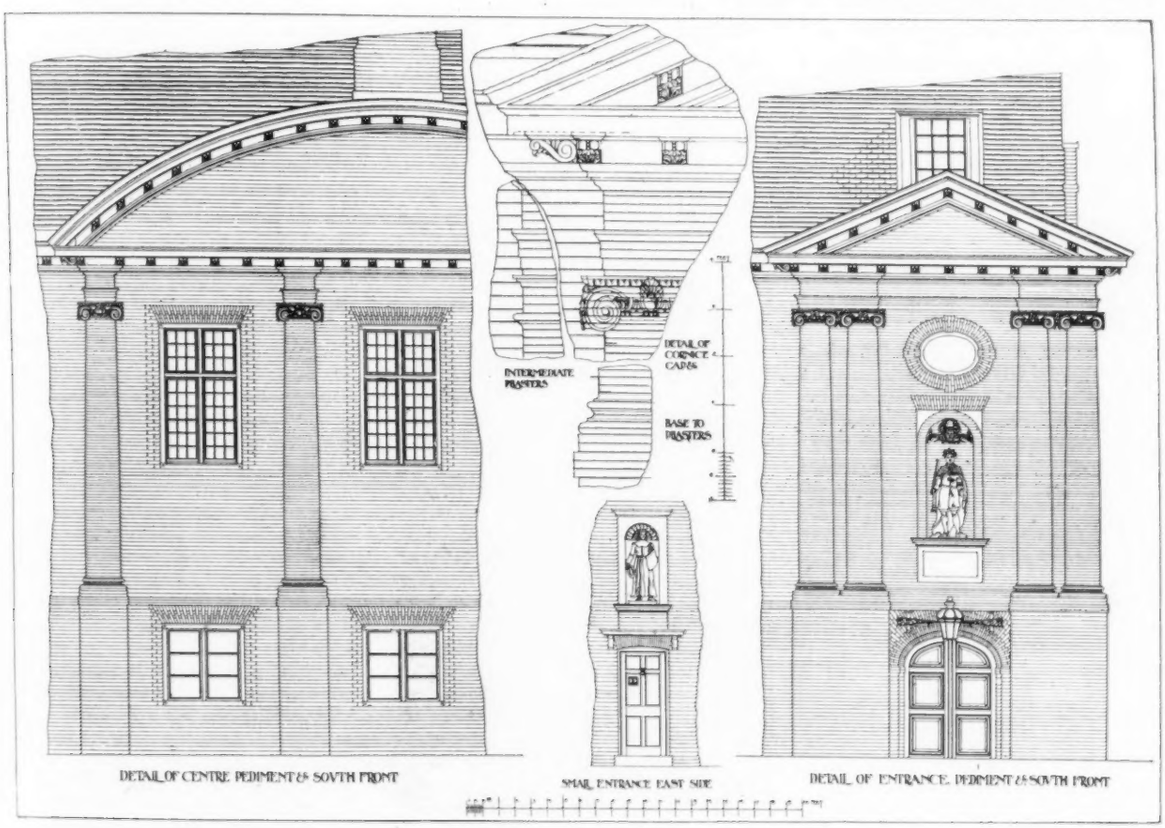
The most characteristic feature of Renaissance brickwork was the flat rubbed brick arch. The wider openings, as gateways, were spanned with elliptical arches. In brick as in stone the Orders formed the great decorative resource of Renaissance architects. Heavy classic cornices were built up of 2½-inch bricks often with dentils and modillions, tiles being used in the early work for the smaller fillets. Effective strings were formed of three or four courses of brick, slightly projected.

LITTLE LEIGHS PRIORY, ESSEX.

1538. — *Hengrave Hall, Suffolk.* Commenced late in the reign of Henry VIII., this building indicates the first change of importance towards Renaissance examples. Brick is employed throughout for facing work but stone takes its place for all architectural features.

Circa 1600.—Hatfield House at Hertfordshire, Bramshill House at Hampshire, Burton Agnes Manorhouse at Yorkshire, Aston Hall at Warwickshire, and not a few of the Cambridge colleges belong to the early Renaissance period. They are largely faced with brick but stone is used for all ornamental portions, the chimneys alone showing an architectural use of brick. Dutch influence, especially in gables, becomes more noticeable in the early part of the seventeenth century; the introduction of Flemish bond about this time being significant.

1604. — *Kew Palace.* An early illustration of the Dutch


DETAIL OF CORNICE CAPS
INTERMEDIATE PILASTERS
BASE TO PILASTERS
DETAIL OF CENTRE PEDIMENT & SOUTH FRONT
SMALL ENTRANCE EAST SIDE
DETAIL OF ENTRANCE PEDIMENT & SOUTH FRONT

DETAILS OF CHRIST'S HOSPITAL.

BANQUETING HALL, KENSINGTON PALACE.

KEW PALACE.

influence. The windows have projecting architraves of 2-inch rubbers, with every third course sunk as a rustication. The cornices and projections are covered with tiles — which is always an early indication.

There is also a suggestion of Flemish influence in Pendell House, Bletchingly, which has been attributed to Inigo Jones. It has curiously-shaped arches over the ground-floor windows, and exceedingly interesting chimneys.

Jacobean brick mansions are by no means rare but the brick revival, destined to continue until the beginning of the nineteenth century, did not become general until the latter half of the seventeenth.

HAMPTON COURT PALACE.

1630. — *Inigo Jones' Brickwork.* Inigo Jones, like his master Palladio, was by no means averse to brick though using it little in his more important works. West Woodhay Manor-house, an apparently authentic design by Inigo Jones, shows an early use of rubbed brick in its window architraves. In Raynhall Hall, Norfolk, and Chilham Castle he employed brick for facing only, while Stoke Park shows it used in rather a Palladian manner for pilasters. St. Paul's Church, Covent Garden, London, was probably the first use of brick in Renaissance church building in England. The fine brick house at Tyttenhanger, Hertfordshire, has been attributed to Inigo Jones but its date and character appear to be somewhat later.

Wren's Brickwork. Wren's use of brick is characteristic of his natural strength and decision. For church work he evidently preferred stone, employing brick only for constructive utility as in the cone of St. Paul's Cathedral, or for an economical facing as at St. James', Piccadilly, London. In domestic work he used brick indiscriminately considering it to be as suitable for the palace as for a terrace house. He appears to have carefully considered the color of his brickwork, and for almost the first time introduced yellow stocks. The quality of Wren's brickwork was as excellent as his design.

1672.— *Christ's Hospital, London.* Designed by Wren. Among the rather unusual features of this design were the cut and rubbed brick Ionic pilasters and capitals. The building was demolished about six years ago.

1682. — *Chelsea Hospital and Kensington Palace, London.* Designed by Wren. These structures rely largely for effect upon the fine color of the red and yellow brickwork. The famous banqueting hall of the latter indicates close sympathy with brickwork combined with knowledge of its limitations. Protected portions, as the heads of niches, are beautifully formed in brick. The slightly-recessed arches on the ends are a surface decoration, easy and effective in brick.

GATEHOUSE AT HADLEIGH, SUFFOLK.

1688. — *The Bluecoat School, Westminster.* This is perhaps the most careful and consistent of Wren's brick-building.

Here the pilasters, capitals, and cornices are of cut brick similar to his other buildings.

At Hampton Court Palace Wren used his color broadly, contrasting an ordinary dull red in the lower story with the bright red of rubbed and gauged brick above.

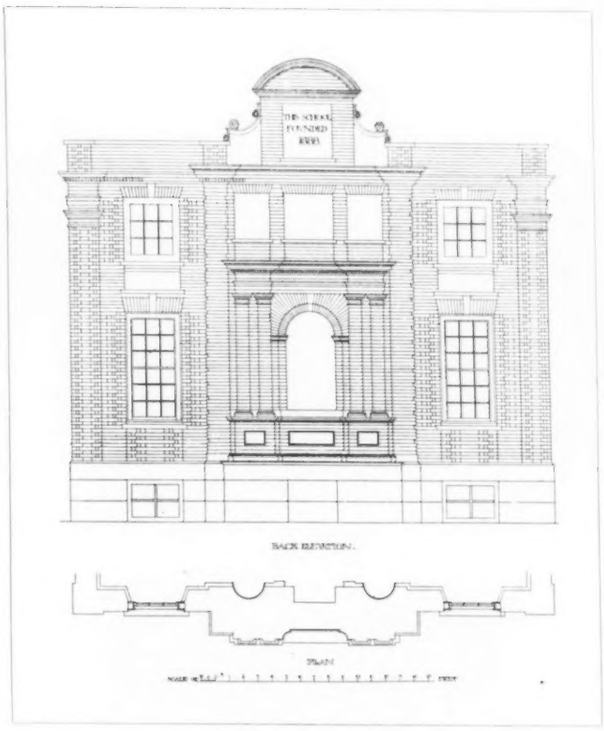
Eighteenth-Century Brickwork.

The brick style initiated by Inigo Jones at West Woodhay and popularized by Wren became the vernacular for the whole of the eighteenth century. For Queen Anne and Georgian alike, brick was the medium in which were ex-

pressed the comfort and dignity of the English house.

Of town houses the finest examples of the period remaining in London are Nos. 42, 43 and 44 St. Martin's Lane. In No. 43 the Roman Doric Order is rendered completely in brick from the fluted pilasters to the guttæ on the soffit of the cornice. No. 44 has a correct Ionic cornice with dentils, and No. 42 an enriched Corinthian cornice with modillions—all in brick.

The climax of Renaissance brickwork was followed by a decline, hastened by general introduction of stucco in the late eighteenth century. This militated not only against the artistic value of brickwork, but also against its constructional quality. Not a few of the bulging walls of to-day may be attributed to the careless brickwork of the age of Nash.



THE BLUECOAT SCHOOL, WESTMINSTER.

NINETEENTH-CENTURY BRICKWORK.

The revivals of the nineteenth century induced from necessity a renewed vigor of brick practice. Impelled by economic considerations to build in brick the great Gothic Revivalists employed that material with architectural enthusiasm for all but their most important works. Pugin by the inclusion in his "Examples" of such buildings as Oxburgh, East Barsham and Great Snoring stimulated the movement. Butterfield did pioneer work in brick at All Saints' Church Margaret Street, London.

Nesfield produced some beautiful brick lodges at Regent's Park and Kew Gardens; and Street, with his literary research in Northern Italy and practical work, continued the movement in a score of churches.

The possibilities of glazed bricks seem first to have been attempted by Butterfield, as in the interior of All Saints' Church.

Of the brickwork that has been done in England since the Gothic Revival it is impossible now to give a survey, as apart from the invidiousness of differentiating between the work of living architects, the task would occupy too much space. Suffice to say that brickwork, especially for domestic buildings, is being very extensively used by English architects with notable success in many cases. It has attained its present position of general usefulness by its ready adaptability to requirements, and whatever method of construction may determine the course of urban architecture in the future, brick is likely to remain the building material most suited to express the amenities of English country life.

LODGE IN KEW GARDENS.

DOORWAY IN THE CLOSE, SALISBURY.

THE recent excavations of the Roman Villa at Northfleet, England, have proven of immeasurable value to the antiquarian student. Among other important discoveries has been found the existence of an ancient ruin about two feet below the foundations of the present structure. Another valuable "find" is a large kiln built entirely of blocks of chalk lined with red clay, burnt through the process of firing to red brick. Buildings erected wholly or partly of blocks of chalk are to be found in the chalk district dating back to the Norman period, or even earlier, and Roman kilns built partly of chalk are comparatively common. This new kiln is uncommon, on account of both its material and its size.

Editorial Comment and Miscellany.

PLATE ILLUSTRATIONS—DESCRIPTION.

STABLE AND GARAGE AT 146 EAST 57TH STREET, NEW YORK CITY. PLATE 114. The building is faced with brick, laid in Dutch bond with wide joints raked out. The general tone of the brickwork is a deep purplish red. The roof tile is of a dull green. The coach room, lofts and repair shop are all accessible for vehicles by means of a 10 foot by 16 foot electric lift of 4500 pounds' capacity in a fireproof shaft. The floor of the stable is of clinker brick, the coach room of gray flint tile, and the living apartments and stairs composition with 6 inch cove base. Beneath the sidewalk of clinker brick is storage accommodation for gasoline, etc. The cost of the building per cubic foot was 28 cents. In cubing the distance was taken from the cellar floor level to the top of the roof surfaces and from the outside of walls, not including parapet walls and sidewalk.

HARRINGTON CHILDREN'S HOSPITAL, BUFFALO. N. Y. PLATE 101. The building is of fireproof construction throughout. Upon the interior the halls and toilet rooms have marble floors and wainscoting. The stairs are also of marble. Each ward is equipped with outside verandas. The building contains approximately 200,000 cubic feet, the cubage being taken from the foundations to the top of the roof. The total cost was $50,000, or 25 cents per cubic foot.

SEAL OF MIAMI UNIVERSITY, OXFORD, OHIO.
Frank L. Packard, Architect.
Executed in faience by the Rookwood Pottery Company.

COLOR IN ARCHITECTURE.

THE value of color in architecture is the subject of a discourse by Halsey Ricardo, F.R.I.B.A., England. Mr. Ricardo believes that man should employ color in buildings since nature colors all her works. He refers to the Egyptians, Greeks, Persians and Assyrians, as well as mediæval nations, who enriched their buildings and monuments with color. Such examples he thinks should inspire the designer to works of art that will furnish a sense of pleasure, interest and added value to what might otherwise be commonplace.

DETAIL BY CROW, LEWIS & WICKENHOEFER, ARCHITECTS.
Made by Conkling-Armstrong Terra Cotta Co.

The subject divides itself into Structural Decoration and Decorated Construction. Structural Decoration is the use of such materials as have in themselves the color required for decorating the buildings as works of architecture; while Decorated Construction refers to the application of colored decoration. He goes on to cite Notre Dame of Paris; Sancta Sophia, Constantinople; S. Miniato, Florence; and St. Mark's at Venice as notable examples of decoration. Mr. Ricardo is a strong advocate of Structural Decoration. He claims that the glazed materials are alone able to withstand the corrosion of the atmosphere and avoid the permanent disfiguration of its impurities. He states that while glazed bricks and glazed terra cotta lose the mellowing effect of time and weather, they are impervious to both rain and wind, always clean, and have an endless variety of color.

After discussing briefly the stained glass work in which the primary colors were chiefly used, Mr. Ricardo completes his discourse by saying: "Had nature applied but one color to all objects they would have been indistinct in form as well as monotonous in aspect. We must appeal to experience and be indebted to the past for its wondrous works, if we expect to realize our ideals for the future; for color is essential to the completeness of any work of architecture, as distinguished from simple buildings, even if only its aim is to please."

COMPETITION FOR A NEW CAPITAL.

A GREAT town-planning competition will be announced before long by the High Commissioner for the Commonwealth of Australia, who is almost ready to go ahead with the construction of the new federal capital. This has been located at Yass-Canberra, in New South Wales, about equally distant from Sidney and Melbourne and one hundred miles inland. Here a tract of some nine hundred square miles has been turned over to the Commonwealth, and engineers and surveyors have been busy for some time

DETAIL BY ROUSE & GOLDSTONE, ARCHITECTS.
South Amboy Terra Cotta Company, Makers.

DETAIL BY JAMES KNOX TAYLOR, ARCHITECT.
Made by O. W. Ketcham Terra Cotta Works.

obtaining topographical data relating to it, for the purpose of the proposed international competition. One feature of the undertaking is unusual; the land cannot be sold but can only be obtained on lease from the federal government. Consequently, while the administration buildings must inevitably be constructed by the government, there is considerable uncertainty regarding the way in which houses for the officials and members of parliament should be provided. This is the first occasion since the laying out of the City of Washington when a national capital has been presented to engineers and architects for complete planning. Moreover, this capital is for an entire continent, so that the competition has an unusually unique character. The site is apparently one which will call for great skill in its development, for a river winds through it and there are irregular, rather gentle hills everywhere. The river can be dammed in order to make a small lake, if desired, and on this account the variety of plans that may be prepared for the development of the site is very great. The authorities are apparently proceeding in a very careful manner, with the intention of leaving the design wholly to the competitors, furnishing merely topographical information and a statement of the accommodations needed by the government.—*Engineering Record.*

ANXIETY OVER THE ARCHITECTURE IN ROME.

CONSIDERABLE anxiety among all lovers of art has been aroused over some of the projects contemplated in Rome. In 1911 that city will celebrate the fiftieth anniversary of the proclamation of Rome as the capital of Italy. The committee in charge of affairs feel that they cannot carry out their elaborate plans without connecting the three buildings on Capitol Hill by two permanent additions. The piazza together with this group of buildings was designed by Michelangelo Buonarotti and has existed for centuries as a model of proportion and dignity. Michelangelo had very little space at his disposal, but he made the most of it by various devices, one of which was to leave two openings between the lateral and central buildings. To connect these would not only shut off all the openings towards the Forum and Palatine but would also affect materially the harmony of the original design. We hope this project will not be executed, for it will destroy the appearance of one of our historic creations and at the same time add fuel to the already large and insane desire of changing or demolishing the splendid architecture of the past.

DETAIL FOR AN OFFICE BUILDING.
Atlantic Terra Cotta Company, Makers.
Henry Ives Cobb, Architect.

MAIN ENTRANCE TO LIBERTY TOWER BUILDING, NEW YORK CITY.
Architectural Terra Cotta executed by Atlantic Terra Cotta Company.
Henry Ives Cobb, Architect.

THE UNIFICATION OF THE ARCHITECTS IN PENNSYLVANIA.

WE NOTE with interest the earnest effort being made to unify the architectural profession in the State of Pennsylvania. The Association of the American Institute of Architects in that state issued some time ago through its officers a circular letter asking for the co-operation of all the members of the association and of the profession. The letter called for assurances of interest in the organization and opinions as to the best methods of

DETAIL BY ROOT & SIEMENS, ARCHITECTS.
American Terra Cotta Company, Makers.

establishing the Pennsylvania State Association as a vital factor in the Commonwealth. Such a hearty response has come from all sections of the state requesting information as to the method of applying for admission that the association has been compelled to issue another circular letter in regard to this inquiry alone. There is no better way to have its influence felt as a power for good than the united and concentrated action of all the professional men that have expressed their desire to join the organization.

PITTSBURG'S BIG LAND SHOW.

ARRANGEMENTS are being made under the auspices of the Pittsburg *Gazette Times* and the Pittsburg *Chronicle Telegraph* for a big land show to be held in Pittsburg, October 27th to the 29th. The exhibition will be wide in its scope and will include among its contributors the United States Government, the various States of the Union, Boards of Trade, Chambers of Commerce, commercial bodies and irrigation companies. The object of the exposition is to provide information to the farmer, the homeseeker and the investor regarding land openings and developments in all sections of the country, and at the same time to teach the student and laymen the educational facts concerning land reclamation and irrigation. Samples will be shown of all mineral, agricultural, horticultural, and botanical products of the soil.

AN OPEN AIR PULPIT.

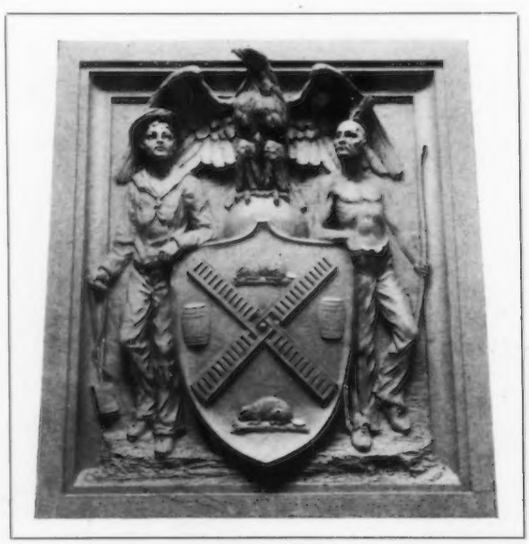
A WORK of unusual interest among architects as well as laymen is the open air pulpit that has been designed for Grace Church, New York City. This is the first experiment of this nature that has been undertaken in the United States. In Europe, however, these pulpits built on the outside of churches are very common, especially in Italy. At Perugia there is an open air pulpit attached to the side wall of the church, which may well be styled the prototype of this one belonging to Grace Church. The pulpit faces Broadway and is

DETAIL BY WARREN & WETMORE, ARCHITECTS.
New Jersey Terra Cotta Company, Makers.

designed in white marble after the Gothic style of the fourteenth century. The base is ornamented with the symbols of the four Evangelists, while the parapet is adorned with the figures of the Evangelists. The panels are carved to represent the Sermon on the Mount.

BUILDING OPERATIONS FOR JULY.

OFFICIAL reports from fifty building centers throughout the country, compiled by The American Contractor, New York, show a loss in the aggregate of twenty-two per cent for July, 1910, as compared with July, 1909. Of this amount, New York city assumes nearly three-fourths, a decrease of nearly $15,000,000, or fifty-two per cent. The majority of the other cities in the list contributes their mite to make the total. Thirty-two cities show a loss of from two to seventy-six per cent, and eighteen cities show a gain of from two to one hundred and eighty-five per cent. The principal gains were made in Atlanta, one hundred and eighty-five per cent; Dallas, one hundred and twenty-eight; Duluth, forty-five; Hartford, one hundred and twenty-eight; Los Angeles, ninety-eight; Oklahoma City, ninety-five; St. Paul, forty-four.



DETAIL FOR PUBLIC SCHOOL, BROOKLYN.
Brick Terra Cotta & Tile Co., Makers.
C. B. J. Snyder, Architect.

THE city government of Paris is beginning to realize that it must beautify still more its streets and parks if it is to hold the distinction of being the most artistic city in Europe. They are voting $300,000,000 worth of bonds to carry out the Baron Haussman plan which was formulated during the reign of Napoleon III.

AWARD OF ARCHITECTURAL SCHOLARSHIP.

THE scholarship awarded every year to American students in architecture for a post-graduate course of study at the American Academy in Rome was won by Richard Haviland Smyth of Columbia University. Joseph M. Kellogg of Cornell was highly commended, and Samuel Hyman of Columbia and Harold D. Bouneteau of Boston received honorable mentions. The judges were William R. Mead, president of the academy; S. B. P. Trowbridge, John M. Carriere, Adolph A. Weidman and Francis C. Jones.

A JOINT RAILWAY TERMINAL IN MANHATTAN.

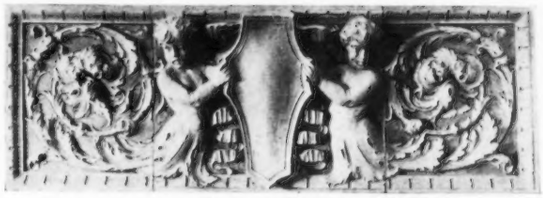
THE Dock Commissioner of New York City has submitted to the city government an elaborate plan for the creation of a joint railway terminal in Manhattan together with better facilities for the handling of transportation. The scheme contemplates a large expenditure for land, docks, an elevated railway structure, upper and lower terminals, floor space for warehouses and storage, buildings used by factories for the fabrication of raw materials, piers with train facilities on the first and second floors and recreation pavilions above, with private passageways from the steamers and car service. At the end of a certain period the terminal is to become the property of the city. The railroads are to pay rental for use of piers, terminals, tracks and float bridges together with light, heat and power. The rental of floor space above will establish a fund for future improvements. The enterprise, as planned, will cost approximately $100,000,000.

ENTRANCE TO CAFE AT DETROIT TREATED WITH HARTFORD FAIENCE TILE.

IN GENERAL.

Thorgils Thoresen has opened an office at 328 Mohawk Building, Portland, Ore., for the practice of architecture. Manufacturers' catalogues and samples desired.

The "Tapestry" brick used for the stable and garage at 146 East 57th street, New York, Albert Morton Gray, architect, was furnished by Fiske & Co., Inc.



DETAIL BY GOLDWIN STARRETT & VAN VLECK, ARCHITECTS. New York Architectural Terra Cotta Company, Makers.

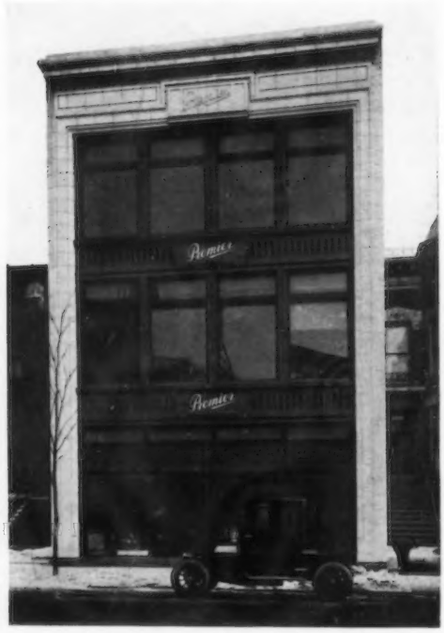
The architectural terra cotta used in the construction of the Children's Hospital, at Buffalo, Green & Wicks, architects, illustrated in this issue, was furnished by the Atlantic Terra Cotta Company.

The firm of C. A. Gill & Son, architects, Dallas, Texas, has been dissolved. C. A. Gill has been appointed supervising architect for Dallas. J. O. Gill, also of this firm, and S. C. Skielvig have formed a co-partnership with offices in the North Texas Building.

The Secretary of the Board of Education at Ionia, Mich., commenting recently on waterproof brick stains said that on all the buildings painted during the past few years Cabot's Brick Stain has proven satisfactory in every way, and is wearing in a thoroughly good manner.

MURAT TEMPLE, INDIANAPOLIS.
All the trim for this building of architectural terra cotta executed by the Indianapolis Terra Cotta Company.
D. A. Bohlen & Son, Architects.

The firm of Temple, Burrows & McLane, Davenport, Iowa, has been dissolved, C. D. McLane having withdrawn. The practice of architecture will be continued by Seth J. Temple and Parke T. Burrows under the firm name of Temple & Burrows. Their office address will remain the same, 62-64 McManus Building.



AUTOMOBILE SALES BUILDING, CHICAGO.

Curtain walls and mullions in dark green terra cotta, balance of building of light cream terra cotta. Northwestern Terra Cotta Company, Makers. Holabird & Roche, Architects.

The Atlantic Terra Cotta Company will furnish the architectural terra cotta for the following new buildings: Municipal Building, New York City, McKim, Mead & White, architects; Rector's Hotel, 44th street and Broadway, New York City, D. H. Burnham, architect; Queen Lane Filter Plant, Philadelphia, Pa.; St. Francis de Sales Church, Philadelphia, Pa., Henry D. Dagit, architect; High School, Norfolk, Va., Neff & Thompson, architects; the last two buildings mentioned will use a large amount of polychrome terra cotta.

NOTICE TO ARCHITECTS. (Competition.)

The Confederate Memorial Association has instructed its Executive Committee to receive Competitive plans for a memorial building in Richmond, Va., to be known as the "Confederate Memorial Institute." The Committee has engaged a firm of architects to act as expert advisers in the preparation and award of the competition.

Cost of building to be $150,000.
Prizes ranging from $1,000 to $200.

Architects desiring to compete should apply for conditions of competition on or before September 30, 1910, to Hon. J. Taylor Ellyson, President Confederate Memorial Association, Richmond, Virginia.

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"SPECIFICATION BLANKS," by T. Robert Wieger, architect (formerly with F. E. Kidder). Forms for all classes of buildings, each trade separate. Complete set, 44 pages, 25 cents. Reduction on quantities. Sample page upon request. 628-14th street, Denver, Colo.

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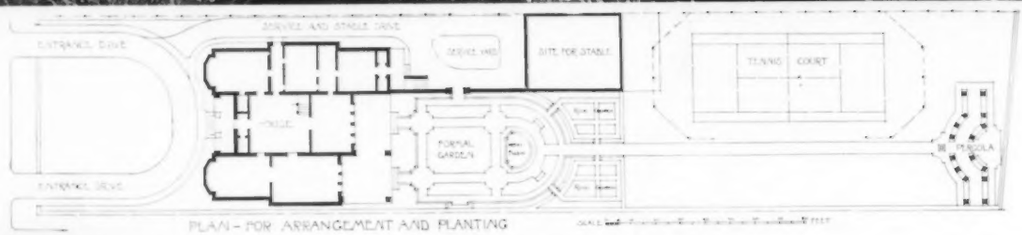


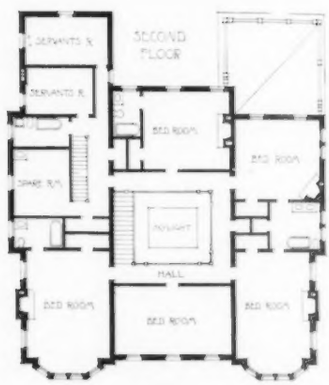
PLAN - FOR ARRANGEMENT AND PLANTING

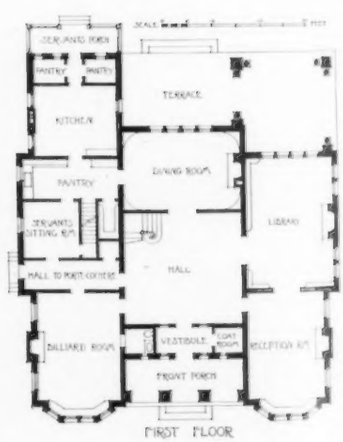
HOUSE AT HUDSON, N. Y.

MARCUS T. REYNOLDS, ARCHITECT.

GARAGE AND GARDEN.

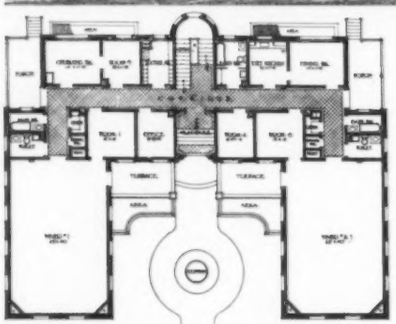
DETAIL OF FOUNTAIN IN WALL OF GARAGE.





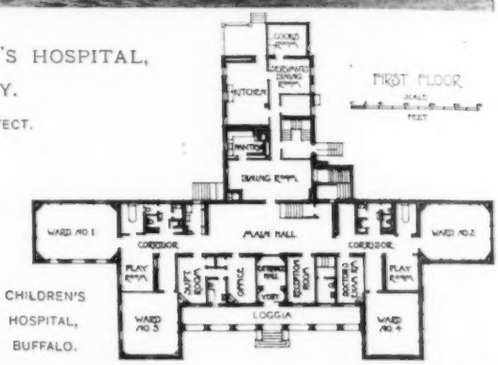
PLANS OF HOUSE.

HOUSE AND GARAGE AT HUDSON, N. Y.
MARCUS T. REYNOLDS, ARCHITECT.



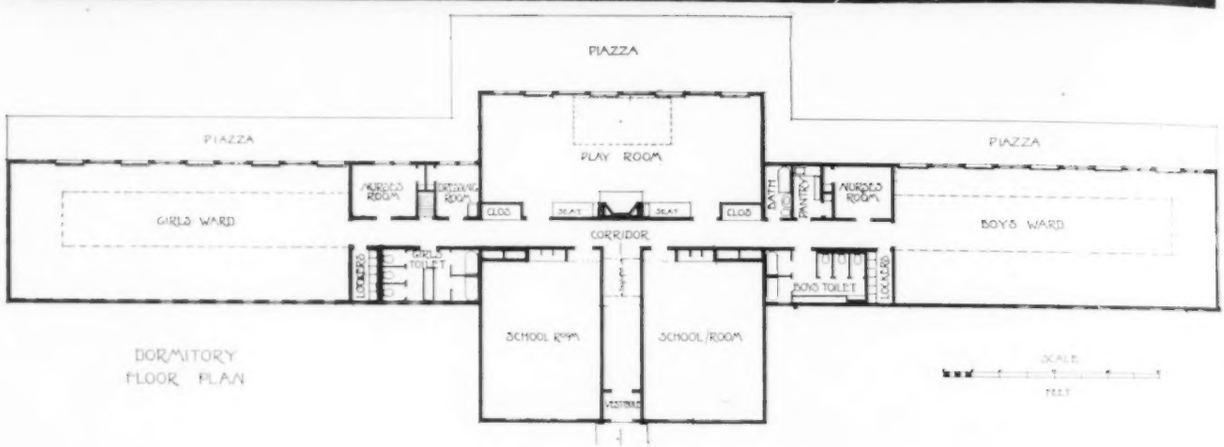
FIRST FLOOR PLAN
HARRINGTON CHILDREN'S HOSPITAL

HARRINGTON CHILDREN'S HOSPITAL,
BUFFALO, N. Y.
GEORGE CARY, ARCHITECT.

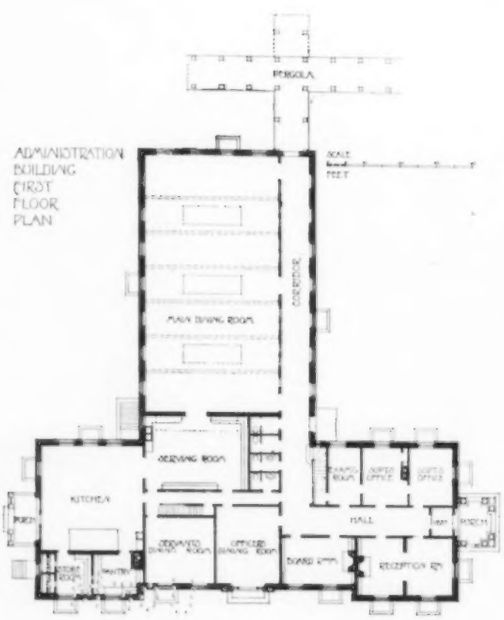


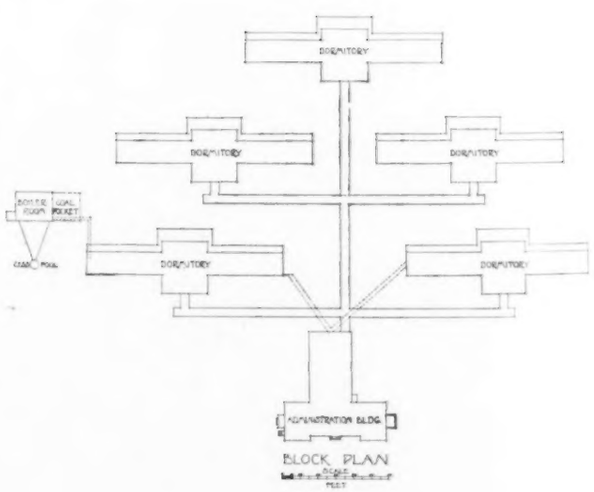
CHILDREN'S
HOSPITAL,
BUFFALO.

CHILDREN'S HOSPITAL AT BUFFALO, N. Y.
GREEN & WICKS, ARCHITECTS.



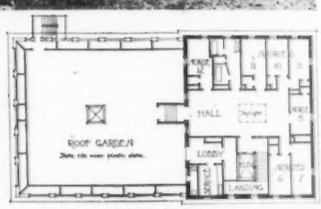
DORMITORY
FLOOR PLAN

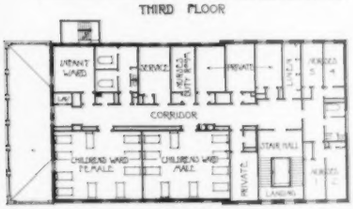


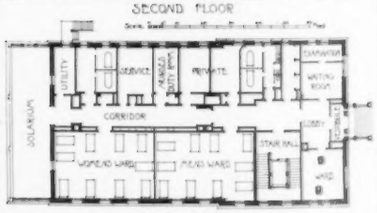


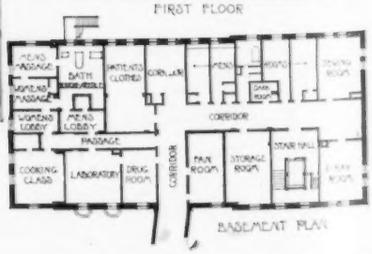
MASSACHUSETTS SCHOOL AND HOME FOR CRIPPLED AND DEFORMED CHILDREN, CANTON, MASS.

BIGELOW & WADSWORTH, ARCHITECTS.



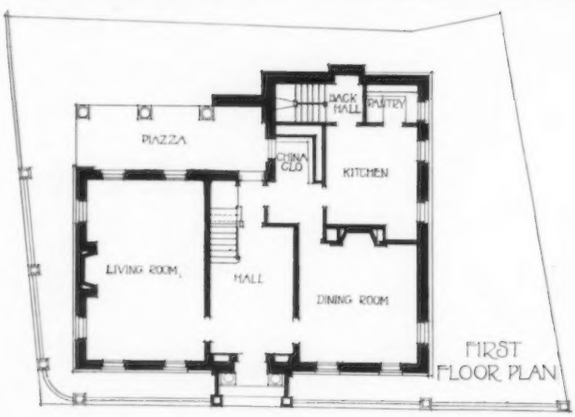






WARD BUILDING FOR CHILDREN, HOSPITAL AT BANGOR, MAINE.

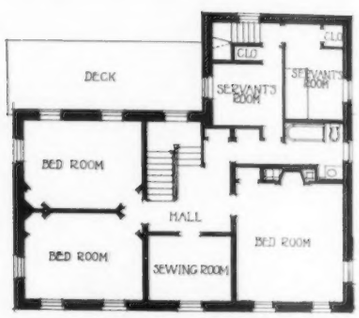
WHEELWRIGHT & HAVEN, ARCHITECTS.



FIRST FLOOR PLAN

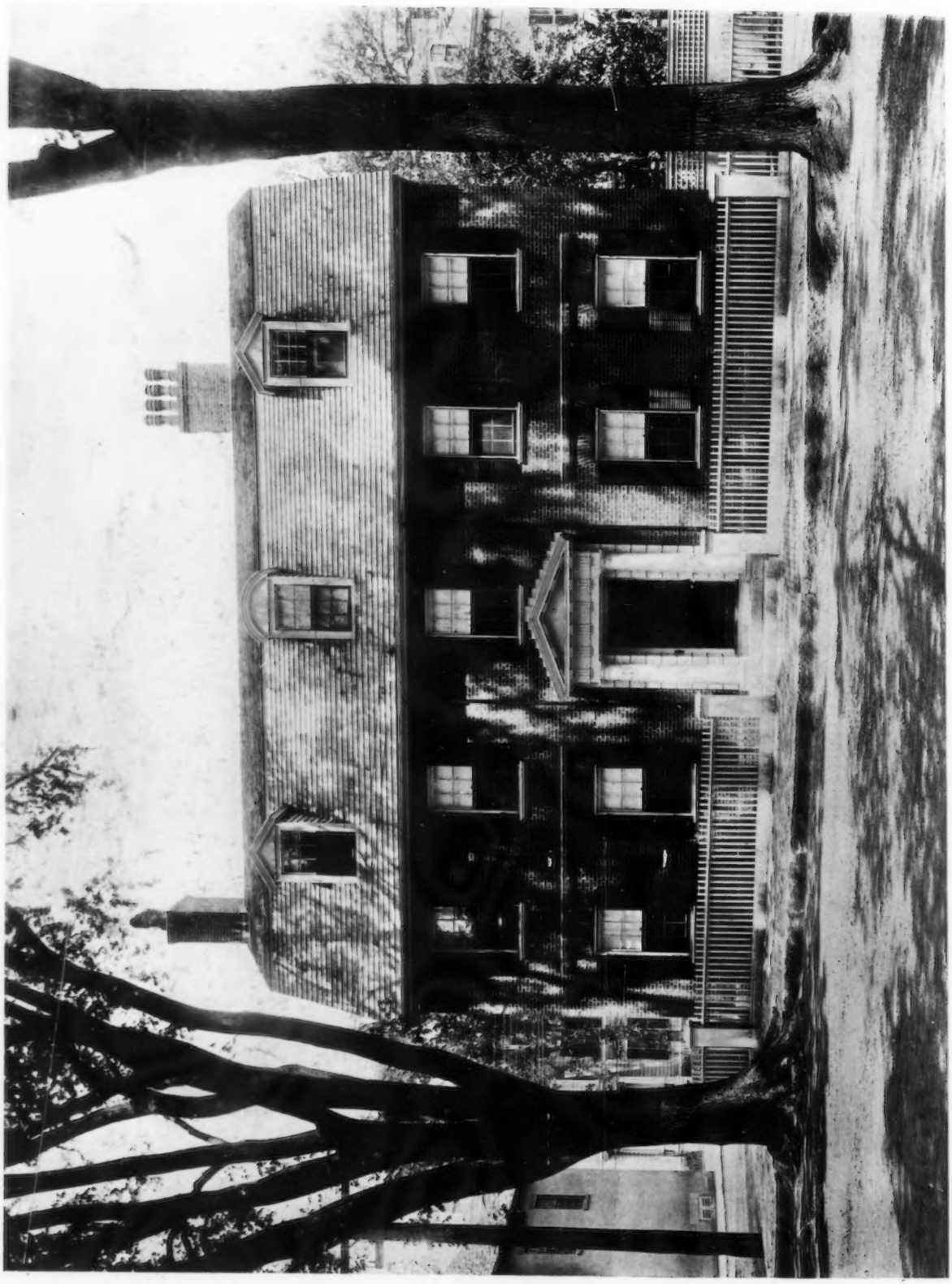
HOUSE
AT
SALEM, MASS.

WILLIAM G. RANTOUL
ARCHITECT.

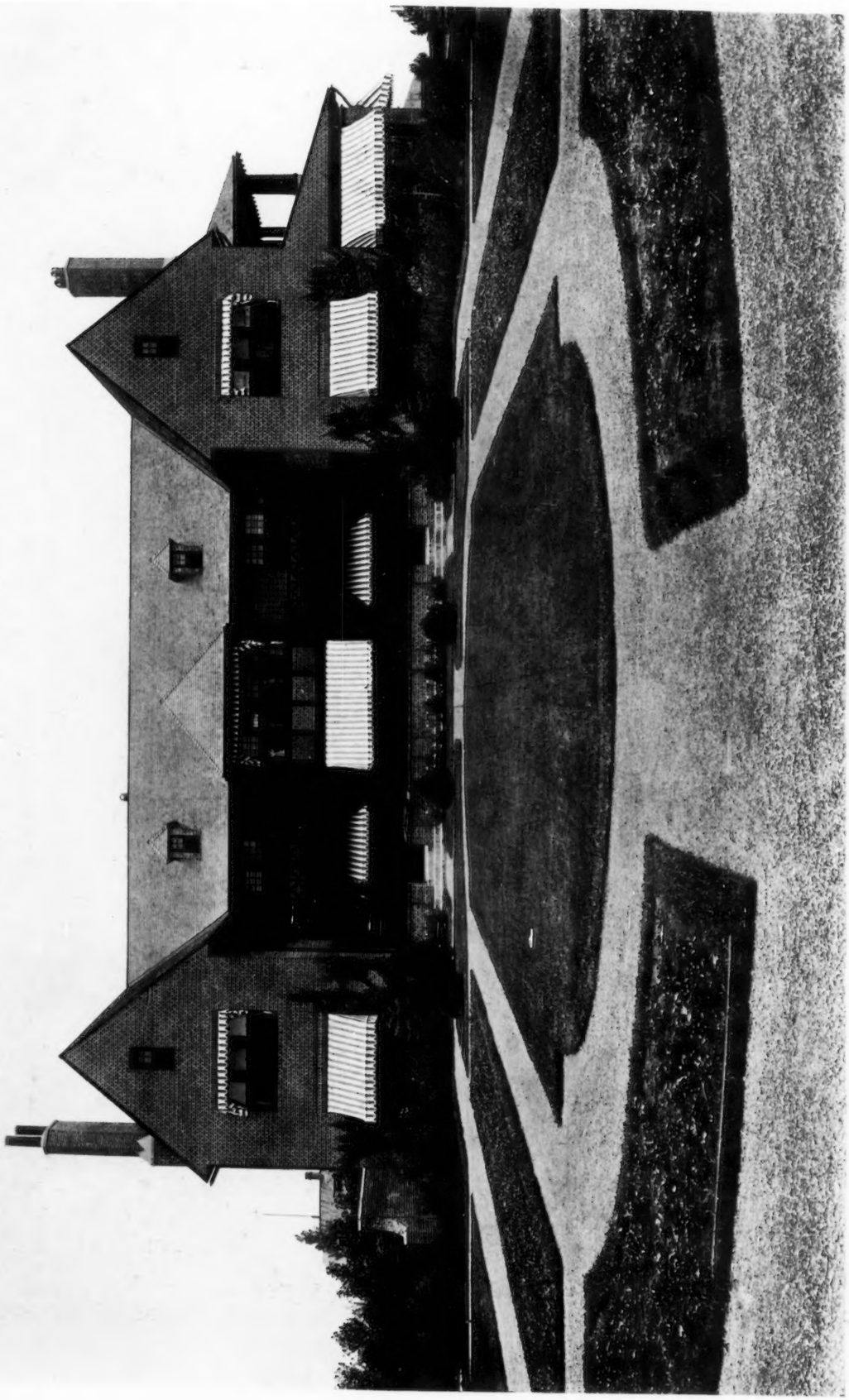


SECOND FLOOR

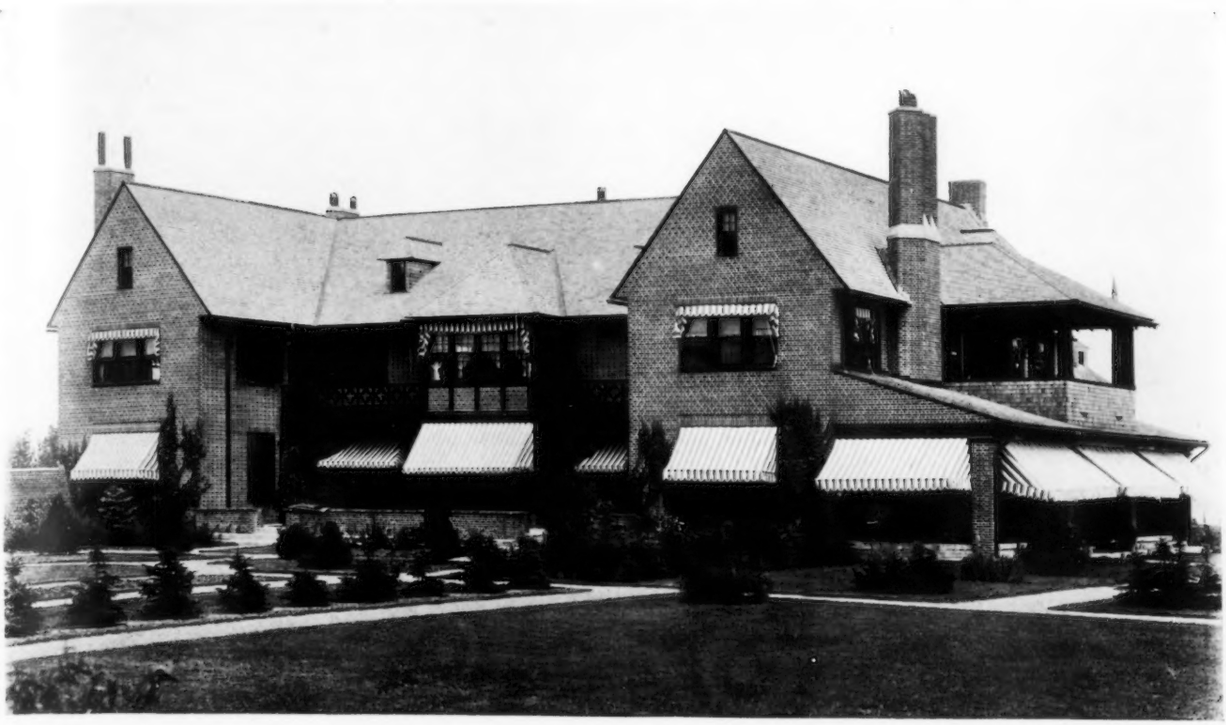
SCALE
FEET

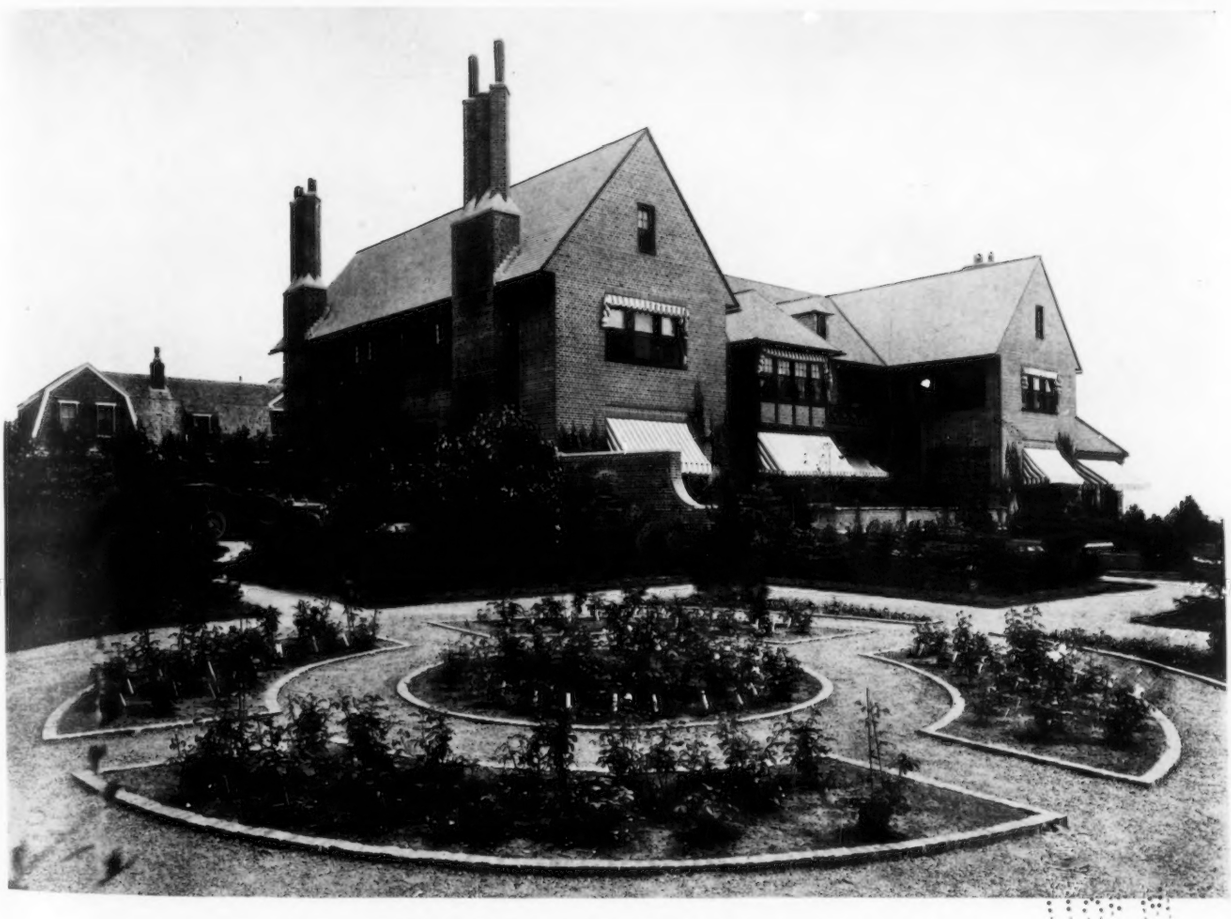


HOUSE AT SALEM, MASS.
WILLIAM G. RANTOUL, ARCHITECT.

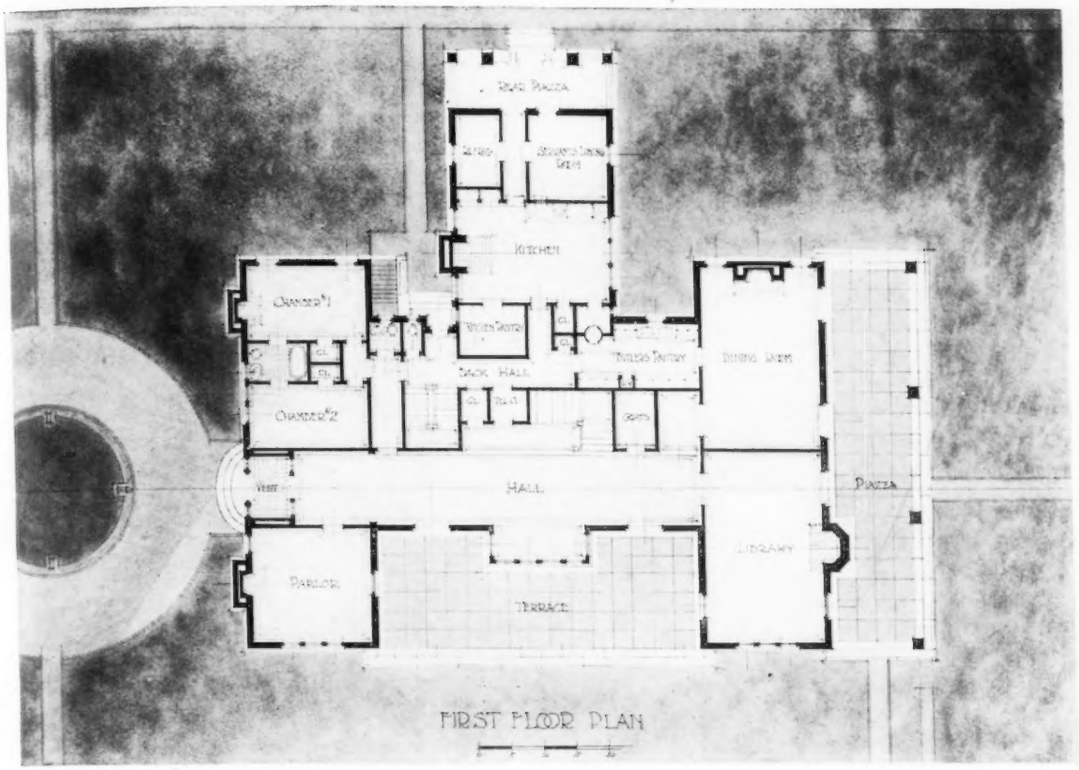


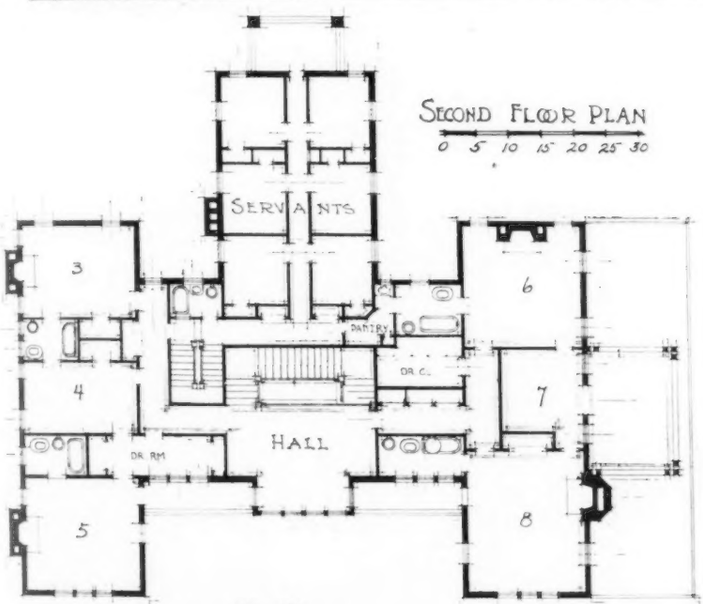
HOUSE AND GARDEN AT MARION, MASS.
PAGE & FROTHINGHAM, ARCHITECTS.





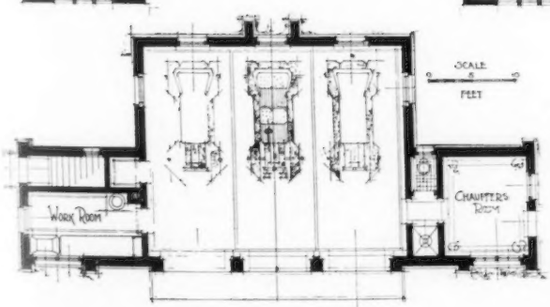
HOUSE AND GARDEN AT MARION, MASS.
PAGE & ROTHINGHAM, ARCHITECTS.



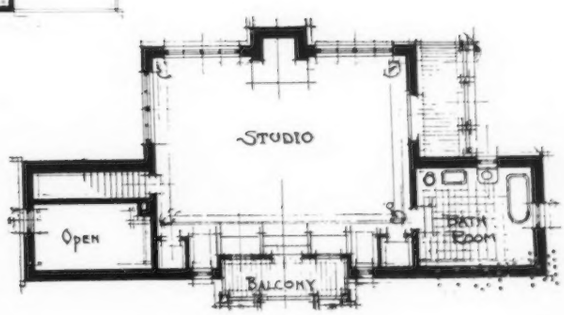


FIRST AND SECOND FLOOR PLANS
OF HOUSE
AND
FIRST AND SECOND FLOOR PLANS
OF GARAGE,
HOUSE AT MARION, MASS.

PAGE & FROTHINGHAM,
ARCHITECTS

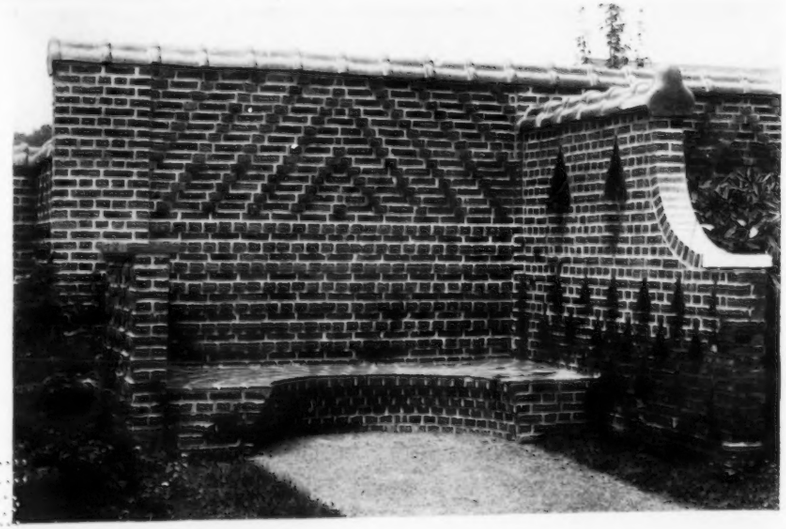


FIRST FLOOR PLAN.



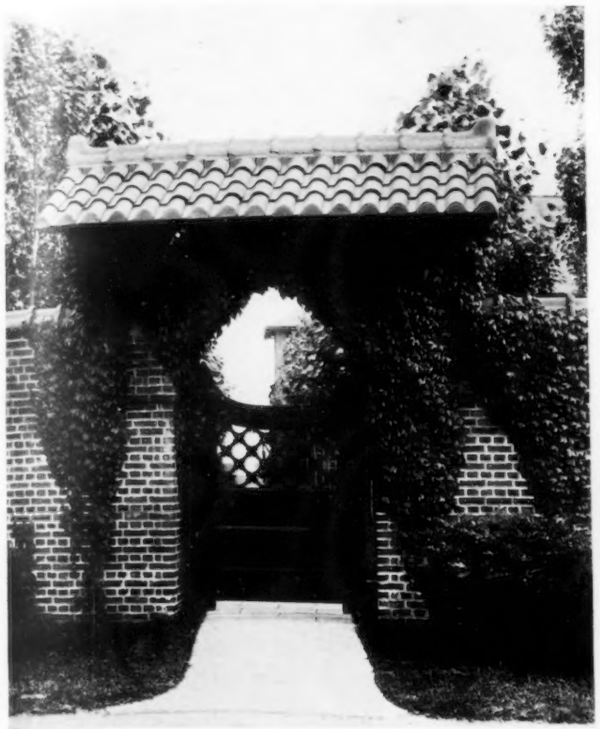
SECOND FLOOR PLAN.

Mrou



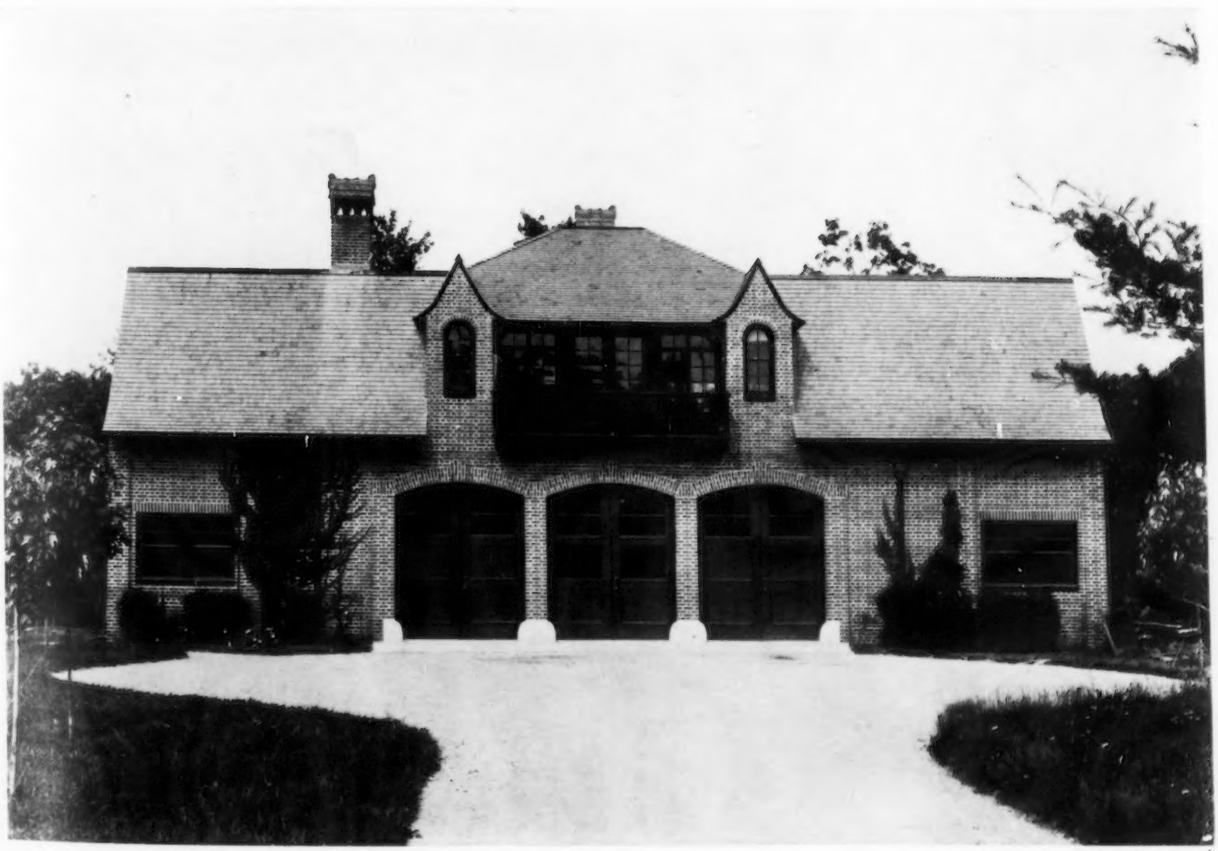
GARDEN DETAILS, HOUSE AT MARION, MASS.
PAGE & FROTHINGHAM, ARCHITECTS.

Mrou



SERVICE ENTRANCE TO HOUSE.

MAIN ENTRANCE, GARDEN SIDE.



ENTRANCES AND GARAGE, HOUSE AT MARION, MASS.
PAGE & FROTHINGHAM, ARCHITECTS

HOUSE AT CONCORD, MASS.
JOHN W LAVALLE, ARCHITECT.

STABLE AND GARAGE, 146 E. 57TH STREET, NEW YORK CITY
ALBERT MORTON GRAY, ARCHITECT.